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The "Broomstick" Train.—Fanciful Conceits of Dr. Wendell Holmes.

In the August *Atlantic Monthly*, Dr. Oliver Wendell Holmes, in "Over the Teacups," causes one of his characters to speak as follows of the electric train:

"There are crowds of people whirled through our streets on these new-fashioned cars, with their witch broomsticks overhead—if they don't come from Salem, they ought to—and not more than one in a dozen of these fish-eyed bipeds thinks or cares a nickel's worth about the miracle which is wrought for their convenience. They know that without hands or feet, without horses, without steam, so far as they can see, they are transported from place to place, and there is nothing to account for it, except the witch broomstick and the iron or copper cobweb which they see stretched above them. What do they know or care about this last revelation of the omnipresent spirit of the material universe? We ought to go down on our knees when one of these mighty caravans, car after car, spins by us, under the mystic impulse which seems to know not whether its train is loaded or empty. We are used to force in the muscles of horses, in the expansive potency of steam, but here we have force stripped stark naked—nothing but a filament to cover its nudity—and yet showing its might in efforts that would task the working beam of a ponderous steam engine. I am thankful that in an age of cynicism I have not lost my reverence. Perhaps you would wonder to see how some very common sights impress me. I always take off my hat if I stop to speak to a stone cutter at his work. 'Why?' do you ask me. Because I know that his is the only labor that is likely to endure. A score of centuries has not effaced the marks of the Greek's or the Roman's chisel on his block of marble.

"And now, before this new manifestation of that form of cosmic vitality which we call electricity, I feel like taking the posture of the peasants listening to the Angelus. How near the mystic effluence of mechanical energy brings us to the Divine source of all power and motion! In the old mythology, the right hand of Jove held and sent forth the lightning. So, in the record of the Hebrew prophets, did the right hand of Jehovah cast forth and direct it. Was Nahum thinking of our far-off time when he wrote, 'The chariots shall rage in the streets, they shall jostle one against another in the broad ways; they shall seem like torches, they shall run like the lightnings?'"

The fancy about the "witches' broomsticks," suggested to another character in "Over the Teacups," a poem on the electric train. It describes how the Salem witches, becoming tired of their life after 200 years' stay in the world below, obtained permission from their master to return to earth. They created a disturbance, whereupon the "Boss of Bedlam" summons them. Dr. Holmes' rhyme continues:

"They came, of course, at their master's call.
The witches, the broomsticks, the cats and all.
He led the hags to a railway train
The horses were trying to drag in vain.
'Now, then,' says he, 'you've had your fun,
And here are the cars you've got to run.
The driver may just unhitch his team,
We don't want horses, we don't want steam;
You may keep your old black cats to hug,
But the loaded train you have got to lug.'
Since then on many a car you'll see
A broomstick plain as plain can be;
On every car there's a witch astride—
The string you see to her leg is tied.
She will do a mischief if she can,
But the string is held by a careful man,
And whenever the evil-minded witch
Would cut some caper he gives a twitch.
As for the hag, you can't see her,
But hark! you can hear her black cat's purr,
And now and then, as a train goes by,
You may catch a gleam from her wicked eye.
Often you've looked on a rushing train,
But just what moved it was not so plain.
It couldn't be those wires above,
For they could neither pull nor shove;
Where was the motor that made it go
You couldn't guess, *but now you know.*
Remember my rhymes when you ride again
On the rattling rail by the broomstick train!"

Electric Headlights on Locomotives.

Electric headlights will hereafter be used on the passenger trains of the Louisville, New Albany and Chicago Road. Contracts have already been let for equipping the three locomotives that haul the night express between Indianapolis and Chicago, and the five engines that haul the night express between Chicago and Louisville, with powerful electric lamps, and one engine now running has already been supplied with the light.

Oxen Supplanted by Electricity.

An electric railway has been built at Boxholm, Sweden, and is the first of its kind in Scandinavia. It is intended for the transport of the various kinds of manufactured iron from the works to the storehouses, which has hitherto been done by the help of oxen. The electric locomotive now draws one or more trucks with a load of about five tons each both up and down. The motive power, in the first instance, is a 50 horse-power turbine, which works two of Wenstrom's well-known dynamos.

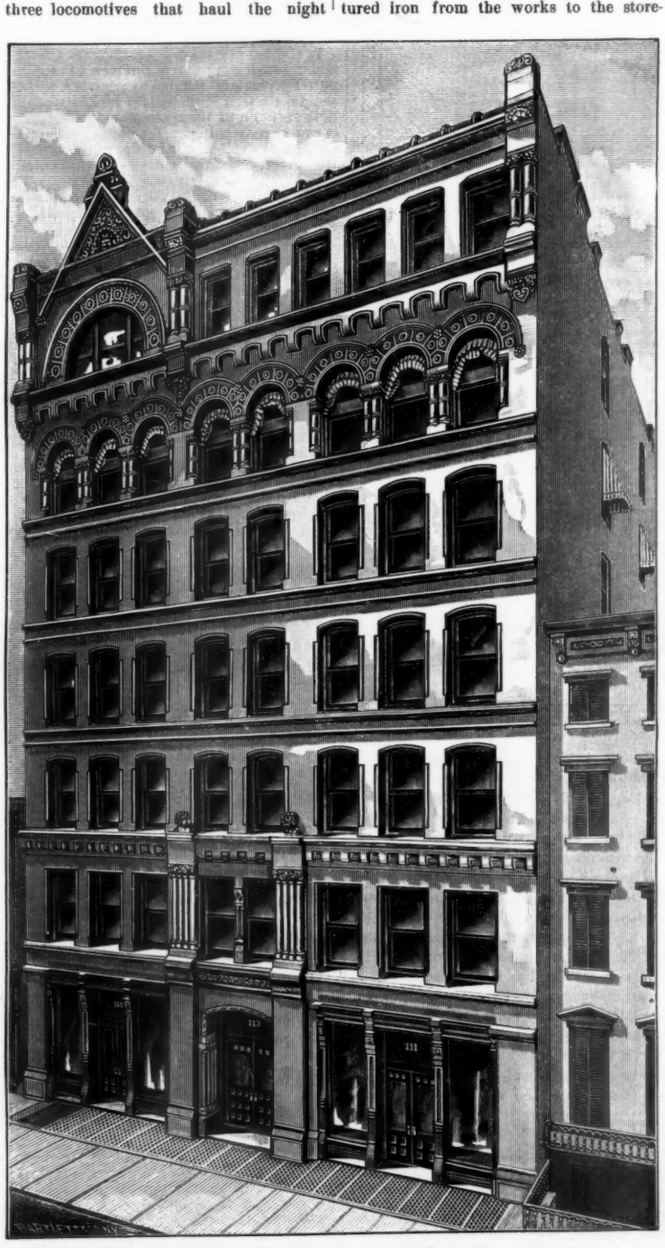

FIG. 1.—NEW TELEPHONE EXCHANGE OF THE METROPOLITAN TELEPHONE AND TELEGRAPH COMPANY, THIRTY-EIGHTH STREET, NEW YORK.

GREAT AND PROGRESSIVE TELEPHONE WORK.

THE NEW THIRTY-EIGHTH STREET EXCHANGE OF THE METROPOLITAN COMPANY GRAPHICALLY DESCRIBED AND ILLUSTRATED—TELEPHONE WORK SCIENTIFICALLY AND ARTISTICALLY DONE—AN INTERESTING ARTICLE FOR THE DELEGATES TO THE TELEPHONE CONVENTION AT DETROIT THIS WEEK.

We illustrate in this issue the latest addition to the New York telephone system. The new building erected by the Metropolitan Telephone and Telegraph Company, in West Thirty-eighth street, and various interesting features of the equipment of the exchange, are represented in the cuts which accompany this article.

The system, as carried out at Thirty-eighth street, represents the highest development of the telephonic art, and in its design and construction, down to the smallest detail, the high-water mark of telephone engineering has unquestionably been reached.

This office is but one of an entire series of similar centers of communication now in course of establishment in the various districts of New York. The new buildings are all fireproof structures, planned and erected by the Metropolitan Company specially for the purpose they are to serve, and they will be essentially, first and foremost, telephone buildings. They will be equipped with the latest and most improved forms of switching apparatus, and will be connected together by a rapid working double track system of underground metallic circuit trunk lines.

Every part of the new construction is carried out on a metallic circuit basis, so that any subscriber can be supplied with a metallic circuit line and secure the benefits of the improved service upon payment of a rate sufficient to cover the extra cost of working under the new system.

With the completion of the Thirty-eighth street exchange, New York has three modern metallic circuit exchanges, viz: Cortlandt street, Eighteenth street and Thirty-eighth street. These three offices have between them an ultimate capacity for handling 13,200 metallic circuit subscribers.

There are now in process of construction three more fireproof telephone buildings of a similar type to that at Thirty-eighth street; one at Spring street, west of Broadway; another at Franklin street, in what is known as the "dry goods" district, and a third at Broad street, in that part of the town where export and commission merchants foregather. These three exchanges, when completed, will have facilities for handling 10,800 additional metallic circuit subscribers. Furthermore, a new central office is now being equipped at Seventy-ninth street and Third avenue, and the switchboard and other apparatus at the present Harlem exchange are being altered to meet the requirements of metallic circuit working. All of

this work involves, practically, the reconstruction of the older plant besides substantial additions of new work.

The extent of the outlay and the amount of engineering skill required in this substitution of new methods for old, are not confined solely to questions of central office equipments. Subways must be built and cables laid between office and office and radiating from the different offices to groups of subscribers, and this through the most crowded streets, both above the surface and below, that are to be found in the world. (It is scarcely necessary to inform our readers that many of these subways are already finished and the cables in operation; between two and three hundred 50-pair underground cables are now connected up at the different New York exchanges and the number is increasing daily). In order to reach the Harlem exchange with underground cables, a subway has to be constructed passing for miles through solid rock, which can only be excavated by blasting. Without further particularizing, it is pretty safe to say that at no period in the history of telephony has such concentrated and well-directed work been brought to bear upon the problem of securing and maintaining good service as that now being pushed forward by the progressive and far-seeing management of the Metropolitan Telephone Company.

To return to the special subject of this article—the new exchange—the entire equipment of the Thirty-eighth street building may be taken as a fair example of the standard of construction which now prevails in the company, and the thoroughly perfect manner in which every part of the complex system of wires, connections and apparatus is installed, forms an object lesson of denial and refutation to the irresponsible statements so frequently circulated in the daily press to the effect that the telephone companies, for some occult reason associated with the expiration of patents, deliberately withhold from the public their best forms of apparatus.

In Fig. 1 is shown a view of the exchange building, which is of fireproof construction throughout and built of Perth Amboy "telephone" brick, with terra cotta and stone trimmings.

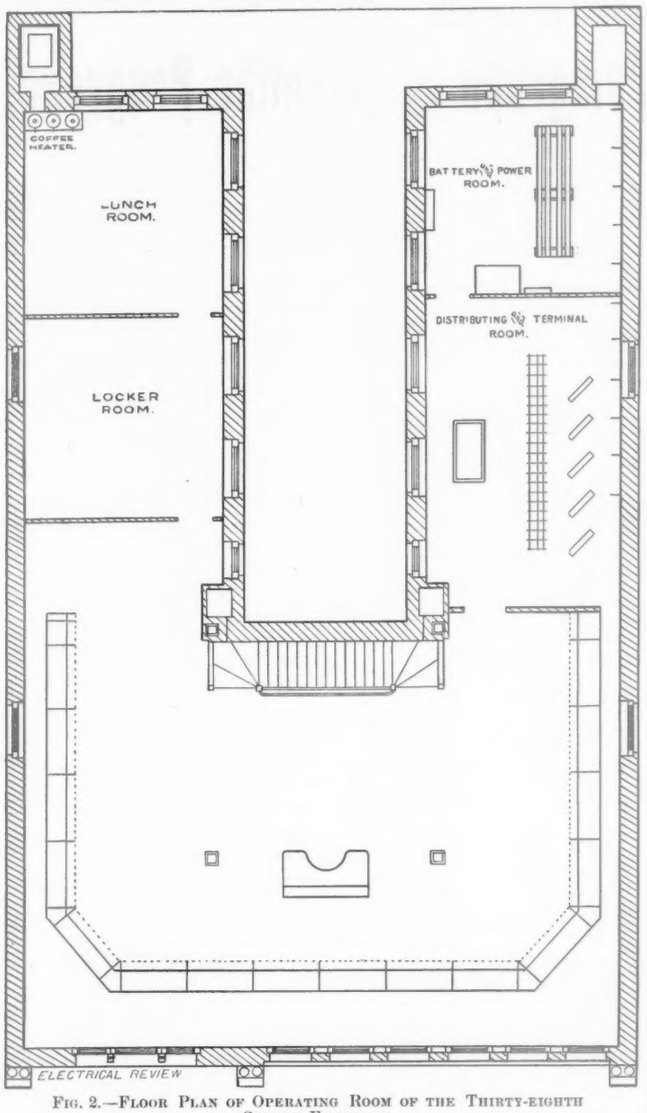

Fig. 2.—Floor Plan of Operating Room of the Thirty-eighth Street Exchange.

In general style of architecture the new building bears a strong family resemblance to telephone headquarters at 18 Cortlandt street. Throughout the building the finish is of the finest and most substantial description, and nothing has been spared to make the arrangements for lighting, heating and ventilation as nearly perfect as possible.

The exchange is located on the seventh floor, a plan of which is shown in Fig. 2. The switchboard, which, it is hardly necessary to say, is of the well-known Western Electric type of multiple board, is arranged in the form of a letter U, the operators working on the inside of the board, thus giving the chief operator a clear view of all that is going on. The room is furnished with a view to affording those using it the most harmonious surroundings possible, the idea being that with a place to work in both comfortable and attractive looking, the work will be well and conscientiously done. The floor is covered with linoleum and a wide strip of carpet extends round the room in front of the switchboard. The chief operator's desk (of a new and improved type, see Fig. 5) stands on a handsome rug; the walls are hung with appropriate etchings and engravings, and in the angles of the room and at other suitable points are placed tropical plants. These comparatively unambitious decorative effects give the whole room a cheerful and refined appearance which must re-act upon the operators, as already suggested, in a manner which is not to be measured in mere dollars and cents. The company's interest in the welfare of their employés does not cease at the operating room; next to it, in the West wing of the building, is an extensive locker room in which each operator has a separate compartment for her belongings. Beyond this is another large room which is furnished with tables and lounges. Here also is stationed a coffee urn, from which coffee is dispensed to the operators, without charge, by a matron who is entrusted with the supervision of the arrangements for the comfort of the girls which we have just described.

Turning again to technical matters, in the East wing are situated the battery and power room and the underground cable terminal room. Here are contained the vital parts of the exchange, and everything is so disposed that the most complete supervision can be maintained over all the thousand and one details, many times repeated, which are inseparable from any such concentration of wires and apparatus.

In the battery room is located the power table, provided with a number of small power generators operated by electric motors. Besides these, a large battery rack, standing in the middle of the room, contains a number of gravity batteries for use in case of an emergency, such as the failure of the motors from any cause; the battery current is used in connection with a rapidly vibrating "pole-changer" which causes the current to change in direction similarly to that produced by the generators. The wires from the generators and batteries are connected to a "power" switch by means of which any generator can be switched on to any section of the switchboard, or, if necessary, two sections of the board may be supplied with current from one generator.

In the terminal room, as its name implies, are to be found the terminals of the underground cables, each provided with their necessary auxiliary apparatus in the shape of strong current arresters and double wound resistance coils. Here also are located the distributing board and chief inspector's desk.

The distributing board, which plays a very important part in the terminal room, is the invention of Mr. A. S. Hibbard, of the Long Distance Telephone Company; a good idea of its construction is conveyed by the accompanying illustration (Fig. 3). The switchboard cables are soldered to clips mounted upon hard rubber strips, as shown in the foreground. The underground cables are extended by flexible cables (not shown) to a similar arrangement on the other side of the board (which is in reality an iron framework). The cross connections from one set of strips to the other are made by means of rubber covered wires twisted in pairs, passed through the framework. The framework or cage which constitutes the cross connecting board is made of iron gas pipe and rods, which afford a light but strong construction; the openings between the rods are large enough to admit of the insertion of the hand and arm, thus facilitating the handling of the connecting wires. All of the lateral cross connecting wires are run on the horizontal planes and the up and down runs are made on vertical planes at the rear; thus the openings at the front can never be obstructed.

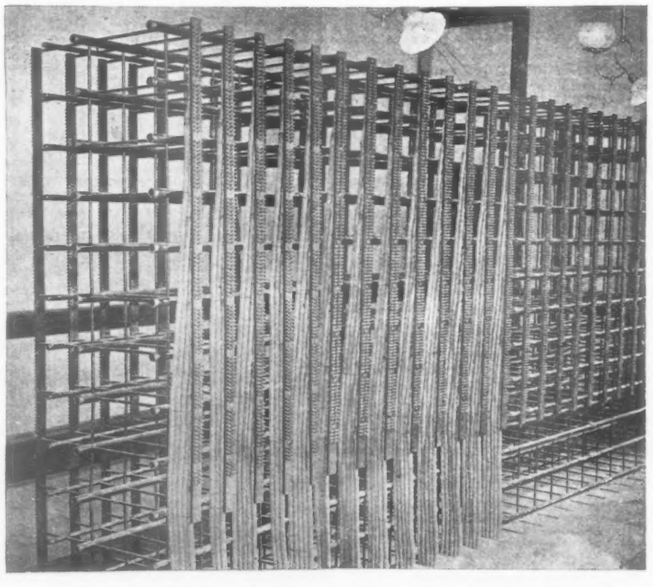

Fig. 3.—The Hibbard Distributing Board, Thirty-eighth Street Telephone Exchange.

This distributing board represents one of the most important advances in central office equipment made during the year and introduces a standard method of arranging one of the most troublesome adjuncts of a busy exchange.

The chief inspector's deck, the location of which is shown in the floor plan in front of the distributing board, is a comparatively new feature in central office equipment. It is of special design, and is provided with a testing outfit, consisting of a Wheatstone bridge, galvanometer, relay, key, etc.

A sectional view of the completed switchboard is shown in Fig. 4. At the top of the board are the condenser, transmitter holder and buzzer. Below these are the subscribers' spring-jacks connected to the switchboard cables supported on a bracket. Under these are the answering jacks, and further down the connecting cords and plugs and the subscribers' drops. These drops are of the tubular pattern, and serve the double function of calling and clearing-out drops. On the lower shelf or keyboard are located the double ringing keys and condenser listening keys. The keyboard is separated from the main part of the switchboard by a "hog-trough," which effects a substantial saving in the reach of the operator. At the bottom of the back part of the board is located the intermediate distributing board, to which all of the return cables are run before they are extended to the answering jacks and drops. By means of this arrangement any line may be terminated at any drop in the system without changing its spring-jack in the face of the board above. Thus it will be seen that the number of subscribers which may be assigned to any operator can be varied according to the amount of business done over the lines, and the work distributed fairly throughout the board—a particularly valuable feature. The retardation coils are placed at the back of the intermediate distributing board, being protected by removable panels. The return cables run in a trough at the rear of the board, as shown in the drawing.

The new exchange, which we have described above, is now operating some 1,600 lines, which formerly terminated at the old Thirty-ninth street office. The ultimate capacity of the Thirty-eighth street switchboard is for 3,600 subscribers, and no doubt when the improved service becomes more generally known and fully appreciated, the increase of subscribers will bring up the number to within measurable distance of the limit.

This is the first office for which there were complete plans and specifications made out and submitted to the manufacturers, and the thorough manner in which the Western Electric Company have completed this installation is but another evidence of the pre-eminent position which they occupy in the telephone field. All of the apparatus described in this article, from the cable heads down to the drops, even including the telephones and transmitters, are the products of their various factories.

Electrolytic Theories.

BY PROF. G. F. FITZGERALD, F.R.S.

Electrolysis has been explained on two different theories by Grotthüs and Clausius. As generally received, they differ. Grotthüs' theory, as generally given, assumes that the molecules in an electrolyte are both polarized and moved by the electric forces within the liquid. This seems so far untenable that it would appear that double the electric force would double both the polarization and the motion of the molecules, and so should produce four times the electrolysis. The objection, however, assumes that we know the causes resisting the motion, and with proper, and not very improbable assumptions as to the resistance to motion depending on it and on the polarization, a linear relation between current and electromotive force, *i. e.*, obedience to Ohm's law, seems possible. A modification of Grotthüs' hypothesis in the direction of Clausius' is, however, possible. Suppose that when polarized the molecules *drew one another apart* at a rate proportional to the polarization. This at once makes the relation between electric force and the decomposition a linear one, and so satisfies Ohm's law in the case of small currents. It also so far agrees with Clausius' hypothesis that it explains electrolysis and double decomposition as properties of the same kind. The molecules in a liquid will occasionally be arranged by accident in the proper polarized condition in a closed circuit for drawing one another apart; and if the circuit includes molecules of different kinds, there will result double decomposition. There seem to be very serious difficulties in supposing that uncombined atoms are for any finite time free in the liquid; and the supposition that it is a particular arrangement that is required before exchanges take place, and that with this arrangement exchanges take place of their own accord, seems to explain electrolysis and double decomposition, without supposing free atoms to exist within the liquid. I have not assumed Prof. Armstrong's suggestion that the proper arrangement for double decomposition is a double molecule; but it seems a likely hypothesis, and one that should be investigated from the chemical rather than the physical side.

There are some other phenomena that have been explained upon the supposition that free atoms are gadding about in a liquid. Such are the lowering of the boiling and freezing points by solution of salts, and their effect on osmotic pressure. If dissociated atoms are going about in a liquid as in a gas, it seems impossible but that they must diffuse at different rates; and that this is not observed seems conclusive against the hypothesis, no matter what else the hypothesis may explain. Consider solution simply. Why does chloride of sodium dissolve in water? There must be some strong affinity between the two of a chemical or semi-chemical nature to break up the cohesion of the crystal; and it seems reasonable to assume that this same affinity keeps the molecules of NaCl moving about among the water molecules, so that they diffuse about. Now, if the forces drawing them about be independent of the nature of the molecule, most of the phenomena explained by gaseous laws are explained. Pressure of a gas depends, at any temperature, on the number of molecules, and not on their kind. This is Avogadro's law, by which molecular weights are calculated; and if the forces drawing a molecule about in a liquid are independent of the kind of molecule, the very same law of pressure would hold, the pressure forward of molecules of different kinds would depend on their number only, and in the same way as Avogadro's law would enable molecular weights to be calculated. In this connection it is well to state that some bodies may, nevertheless, be much better able to produce pressure than others, because of their being more easily polarized, *i. e.*, turned into an effective direction. A molecule which could be easily turned into an effective direction would be about twice as effective as a molecule which went about in a higgledy-piggledy way; and one would consequently expect electrolytes to produce more, nearly double, the osmotic pressure that other bodies did. As to the changes of boiling and freezing points, they seem explicable by exactly the same hypothesis. The reduction of vapor pressure by molecular affinity of dissolved salt would depend only on the number of molecules of salt if all salts have same molecular affinity for water; and the same would apply to the change in freezing point. Hence all these phenomena are explained without assuming free atoms, and they are all explained by what can hardly avoid being a *vera causa*, namely, whatever affinities they are that cause solution, which latter is an unexplained phenomenon on the dissociation hypothesis. That it is reasonable to think that the forces keeping the molecules of salt moving about in the water are independent of the nature of the salt, appears from various considerations. In the first place, these forces are in all probability due to the residual affinities of the non-metallic elements. These same forces are probably the cause of crystallization. These are old suggestions. That these residual affinities should be nearly the same for different combinations does not seem at all unlikely.

If a rather shaky argument in favor of its likelihood on mechanical grounds is desired, the following may deserve attention. Suppose a molecule of NaCl, for instance, at rest, or nearly so, in a crystal. Subject it to this affinity. Its velocity, after it has gone a distance, s, will be given by some such relation as $f s - \frac{1}{2} m v^2$. Now, for the sake of temperature equilibrium, with molecules of somewhat similar structure, $\frac{1}{2} m v^2$ must be the same in all. It seems likely that, at least approximately, the kinetic energy of motion is proportional to the total energy, and that this is the same for each molecular group; if so, the kinetic energy must be approximately the same for different groups. Now, with very dilute solutions s must be nearly the same for different molecules, and if so we get that for temperature equilibrium f must be independent of the nature of the molecule. How this equalization of f for different kinds of molecules comes about may be as follows: Molecules in a liquid move about among one another, but are well within the sphere of one another's attraction, as is evidenced by superficial tension and by the tension to which a liquor can be subject. A very small change in the distance apart of the molecules means, however, a very great change in the forces between them, as otherwise they would be extensible and compressible like gases. It seems likely, then, that when a salt dissolves in a liquid it requires for temperature equilibrium that the distances of the molecules should change by the very small amount required in order that f may become the same for all substances. This very minute change in distance would not sensibly affect s.

FIG. 5.—CHIEF OPERATOR'S DESK, THIRTY-EIGHTH STREET EXCHANGE.

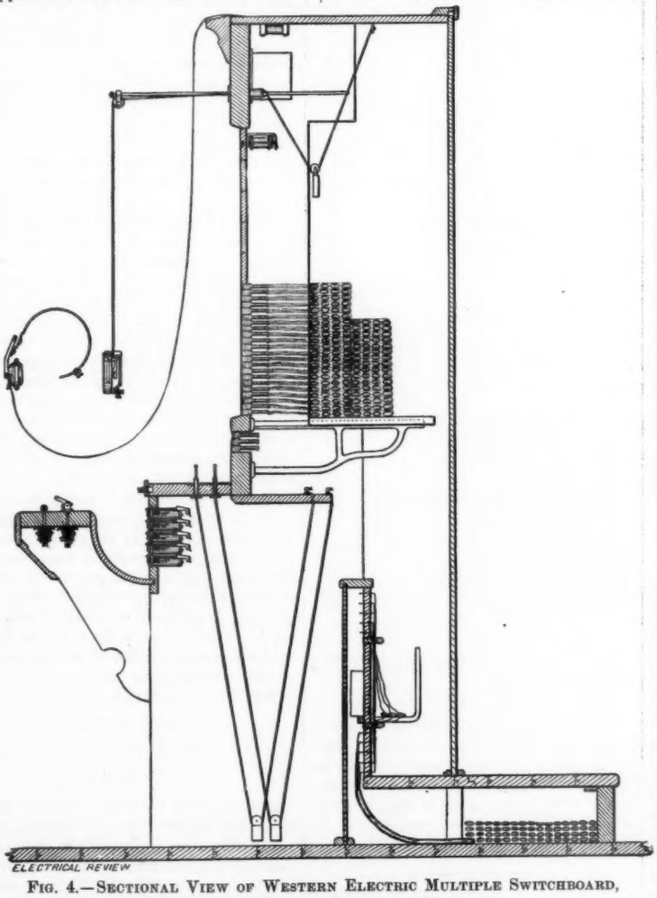

FIG. 4.—SECTIONAL VIEW OF WESTERN ELECTRIC MULTIPLE SWITCHBOARD, THIRTY-EIGHTH STREET TELEPHONE EXCHANGE.

West Winfield, N. Y.—The West Winfield Electric Light Company; capital, $2,000.

Howell, Mich.—The Howell Electric Light and Power Company; capital, $10,000.

Seattle, Wash.—The Seattle Gas and Electric Light and Motor Company; capital, $600,000.

Frackville, Pa.—The Frackville and Gilberton Light, Heat and Power Company, with a capital of $40,000.

San Francisco, Cal.—Pacific Wenstrom Electric Railway Company; directors, C. T. Ryland, Jr., H. T. Scott, John T. Scott, D. I. Mahoney, Dwight E. Ryland; capital stock, $20,000.

Santa Fe, N. M.—Santa Fe Electric Company; capital, $25,000. Directors, E. T. Webber, Denver; T. B. Catron, C. F. A. Fischer, J. G. Schuman and N. B. Laughlin, of Santa Fe.

Chicago, Ill.—Thwing Electric Company, to manufacture and deal in electric lamps and supplies; capital stock, $1,000,000; incorporators, Wilber J. Andrews; Charles B. Thwing and Charles E. Piper.

Tacoma, Wash.—The Commercial Light and Power Company; capital, $250,000. The incorporators are, Clark A. Stevens, Marion G. Denton, Allen C. Balch, Florence M. Wade and Lemuel G. Biglow.

Reading, Mass.—Reading Electric Light and Power Company, capital $12,000. Wendell Bancroft, president; L. M. Bancroft, treasurer; the same and J. W. Richardson, J. A. Horton and E. N. Hunt, directors.

Montgomery, Ala.—The Ball Light and Power Company. The directors of the company are: Messrs. P. B. Bibb, C. G. Abercrombie, Forbes Lidell, W. H. Gesner, F. Lilienthal, Alex. Rice and H. C. Davidson.

Elizabeth, Pa.—Dravosburg, Mendelssohn and Elizabeth Electric Street Railway Company; capital $45,000. The directors are James E. White, John Haben, John K. Skelley, James L. Devenny and Joseph A. Skelly, all of McKeesport.

Stanberry, Mo.—The Stanberry Electric Light Company has just perfected an organization. The first board of directors is composed of D. F. Hill, F. A. Weinner, S. H. Lowers, Norman Ambrose, J. J. Enyart, J. S. Lindley and J. Roy Williams.

Seattle, Wash.—Washington District Telegraph Company; incorporators, A. T. McCargar, E. A. Strout and R. B. Albertson, of Seattle. The object of the corporation is to construct and maintain a district telegraph system, and its capital stock is $3 ,000.

Omaha, Neb.—The Plattsmouth Electric Lamp Manufacturing Company; capital stock, $50,000. Incorporators: Otis H. Ballow, W. H. Schafer, J. C. Cummins & Son, J. M. Patterson, J. M. Craig, J. G. Hays, Timothy Clark, F. E. White, Henry Broeck, William L. Browne.

New York City.—Standard Light Company, to manufacture and sell electric light plants and appliances, and to construct and maintain stations for electric lighting. Capital, $50,000. Trustees: Robert W. Leonard, Edward H. Rath, Arthur A. Tooker, William P. Kookogey and Henry C. Rath.

Oakland, Md.—The Oakland Electric Light and Power Company; capital $7,000. Incorporators, S. T. Jones, J. Lee McComas, Gilmor S. Hamill, A. G. Sturgiss, D. E. Offutt, Henry J. Mayers, Charles S. Davis, Maurice W. Thomas, John W. Hart, George O. Miller, E. K. Goldsborough and E. H. Sincell.

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Brownlee & Co	iv
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Buckeye Engine Co	viii
Bunnell & Co., J. H	xiv
Burton Electric Co	xx
Butler Hard Rubber Co	iii
Cary & Moen	xxi
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How do you like the ELECTRICAL REVIEW this week?

Dr. Bayles' paper on electrical endosmose in this issue treats of experiments in which it was proved that the electric current increased the absorption into the human system of lithium salts given in cases of gout. These experiments were carried out on the lines of a discovery made by Edison.

The quotation on the first page of this issue gives evidence that Dr. Holmes has lost none of his keen sense of humor with the approach of years. The idea of an electric car being propelled by an invisible witch with a string tied to her leg, and the noise of the motor passing as the purring of her black cat, are odd conceits dwelt upon in the peculiar and delicate vein of humor for which Dr. Holmes is so justly famous. It is pat and apt.

Probably before our readers get this far, they will have noticed the change in the make-up of the ELECTRICAL REVIEW. We had to do it; the progressive advertiser was close upon us and in dividing our advertising pages and increasing their number we only followed his wishes and our own desire to keep this paper up to its title of "the standard electrical journal." You will also see that we have given you more reading matter to digest.

The ELECTRICAL REVIEW is a forward thing; at nine years old it is growing faster than its editors grew at 15 years of age. It sometimes puzzles us how to keep it within its clothes—should say, covers. But with all its growth, it has ever a clean face—no advertising appears upon the front cover.

THE PROBLEM OF INDUCTIVE DISTURBANCE.

The interference of power and lighting circuits with signaling circuits presents a problem for inventors, the solution of which promises a large financial reward. The most direct and, perhaps, the most efficient way to avoid the inductive disturbance is to use a metallic return wire on the signaling circuit. Lay the two sides of the circuit parallel and close together, as the induced electromotive force set up in the two wires causes current to tend to flow in the same direction; in fact, they oppose each other, and no induced current really flows presenting an analogy to two opposed batteries inserted in the line. But the enormous expense the establishment of a double wire circuit would entail, especially in cable and telegraph lines, where the signaling stations are remote from each other, calls for some cheaper method of destroying its inductive effect. In all cases where the disturbing influence is confined to a very short stretch, a shunt formed around the section of the signaling wire, which becomes by its proximity to the power circuit the seat of induced electromotive force, the shunt being sufficiently long either to throw one side of the local metallic circuit thus formed sufficiently far away from the disturbing circuit to be but little effected thereby, or to completely enclose the disturbing circuit, would, by offering a local short circuit to the induced current, prevent it flowing to the distant signaling instrument and back through ground. But in neighborhoods, such as cities and towns, where the shunt wire would itself be likely to exposure to other independent disturbing circuits, this mode of avoiding the difficulty would not always be available, even if found entirely efficient. The problem is a very interesting one, worthy the attention of the best workers in the electrical field. Plans which promise well on paper do not always materialize well in practice; it would be well, therefore, in wrestling with the problem, to use bits of wire instead of bits of paper. There is probably a way to do it, but as there is no signboard at cross roads, we shall look for some ingenious electrician to find one and nail it up.

AT THE ELECTRIC CLUB, OCTOBER 2.

The opening of the Fall and Winter meetings of the Electric Club, of this city, by a general "getting together" at the Club house, October 2, will, undoubtedly, prove auspicious and successful. This organization, with such men as President O. E. Madden and Vice-Presidents Erastus Wiman, Grosvenor P. Lowrey, W. D. Sargent and A. H. Patterson at the helm, cannot fail to proceed from success to success and wield a great and progressive influence in the entire electrical field. All interests in this great industry and science have here a home. We expect to see another valuable and edifying lecture season this Winter.

THE NEW YORK TELEPHONE SYSTEM.

It is often alleged through the medium of the omniscient daily press that the telephone companies systematically suppress every new invention in telephonic apparatus and regulate every improvement in methods of line and central office construction to the oblivion of official filing cases, instead of applying one and the other to the improvement of the service, and all this with the object of enjoying to the utmost the benefits of the monopoly by supplying to the unhappy subscribers the cheapest possible service at the dearest possible rates.

That such utterances are very wide of the mark, any one who is at all behind the scenes in telephone circles knows full well, but it must be confessed that in many towns and cities the unsatisfactory telephone service affords some justification for dark hints of the kind we have alluded to, while the complaints of disappointed inventors have no doubt supplied much of the raw material from which they are fabricated. As a matter of fact, the telephone companies in many of the principal cities where the requirements of the service and the magnitude of the subscribers' list justify it, are to-day spending vast sums of money in the construction of metallic circuit systems and underground distribution, the radical changes necessitated by these two reforms requiring the practical reconstruction of old plants and the addition of many new devices of the costliest description.

Nowhere are these changes being more thoroughly carried out than in New York, as an article which we print on another page proves. The building erected by the Metropolitan Telephone Company, in West Thirth-eighth street, and equipped by them from cellar to roof as a telephone building proper, is a magnificent example of a modern telephone exchange, perfect in every detail, arranged for underground distribution, and constructed throughout upon the basis of metallic circuit working. The minute description given this new office in the article referred to demonstrates beyond cavil that the Metropolitan Company is sparing no effort and no expense to render its service as perfect as telephone service in a great city can be made. As a mark of the thoroughness with which the new office is organized, no more pleasing instance can be cited than the attention bestowed on providing the operators with every possible convenience and comfort, and surrounding them, while they are at their work, with objects of refining influence. Certainly, a corporation which keeps such a watchful eye on the comfort and *morale* of their employés, and provides for them in so generous a manner, is not likely to stint in the way of adopting every technical improvement and appliance calculated to secure the most perfect telephone service possible.

It must be remembered, too, that three more such model exchanges are in course of construction in different parts of the city, that the Cortlandt street exchange is the largest in the world, and is on a metallic circuit basis throughout, that other offices have lately been completed or are now being remodelled, and that the Metropolitan Company owns the largest plant of underground telephone cables in the world, and is daily adding to it. Taking all these items into account it will readily be seen that the telephone system of New York is gradually undergoing a complete reorganization, and it would take a good deal of newspaper writing to convince us that such extensive operations, carried out at a very great outlay of capital, are in the least way compatible with the theories of suppression of inventions and improvements so persistently advanced by the daily press.

This is the time of the year that the progressive young man subscribes for the REVIEW, and the past few weeks prove that the p. y. m. is growing in numbers very fast.

He is wise who keeps up with the times.

CLEVELAND, OHIO.

THE GREAT BRUSH ESTABLISHMENT—ELECTRIC RAILWAY WORK—A WELL MANAGED TELEPHONE EXCHANGE—THE "REVIEW" REPRESENTATIVE FINDS MUCH OF INTEREST IN THIS PROGRESSIVE CITY ON THE LAKE.

The Brush Electric Company.—As a matter of course, one of the first things to inquire after in this city is the factory of the Brush Electric Company. And that establishment will have to be inquired after pretty often if one is to keep up with its rapid growth. It is not easy to find the original shop in the five acres of buildings occupied by the company. The principal buildings are the machine shop, 265x122 feet; power building, 100x110 feet; carpenter and pattern shop, 40x125 feet; storage battery building, 100x200 feet; carbon factory, 62x660 feet; coke house, 40x84 feet; lumber shed, 32x70 feet. Besides these, there is the incandescent lamp factory and a separate building occupied by the executive officers and the clerical force. Nearly all the workshops are being enlarged by additions to their height and breadth. Figures give a very inadequate idea of the magnitude of the business carried on. Every portion of the establishment is alive with machinery and men and it is kept going day and night to meet the demands made upon it.

The First Brush Arc Light Dynamo ever made was put up by the well-known pioneer electric illuminater, J. Frank Morrison, in Baltimore, and it is still running to supply 20 public lights in that city. The last Brush dynamo made in this factory is 14 feet long, weighs 22,000 pounds and has a capacity equal to maintaining 5,000 sixteen candle-power lamps. It is designed for the reduction of aluminum at the Cowles Smelting Works, at Lockport, N. Y. There are several other last Brush dynamos. One of them is the 2,500-light Brush-Pfannkuche alternating machine, a peculiarity of which is, that it has revolving field magnets. In the alternating department there are a great number of dynamos and converters, of various sizes, receiving the final tests. The superintendent was apparently doing his best to burn them up, and high potentiallities were flying about in a fashion to quickly settle all the hardened criminals of the Empire State, to say nothing of the milder rascals of the West. A new thing in the arc light department is the Brush-Adams lamp, which is the original Brush lamp with some valuable improvements made by one of the company's electricians. A few of these lamps have been sent to Burlington, Vt., and another lot is being prepared for Altoona, Pa. In the course of a few weeks, the factory will be able to fill all orders. It is a fact worth noting here that the Brush Company always recognizes useful inventions made by its employés and properly recompenses such inventors.

The Railway Department is, just now, one of the busiest in the factory, and Mr. Short spends much of his time there aiding the foremen in expediting the work. A very large number of street car motors, in various stages of construction, are being pushed to completion.

The Carbon Company is turning out over 1,000,000 carbons per month and large quantities are being shipped to Japan.

The Company has Several Important Contracts for isolated plants in the city, including one for the Cleveland Arcade Company, of which Geo. S. Brush is the president and principal owner. The Arcade Building is a massive stone structure, ten stories high, and is to cost one and a quarter millions of dollars. It will be lighted by 100 arc lamps and 3,500 incandescent lamps. There are less than 200 municipal lights in the city and the utility of the solitary tower in the public square is difficult to understand. It is neither ornamental nor useful. Very many stores and other business places are lighted by arc lamps, and both the central stations are doing a good business.

There are about 100 Miles of Electric Railroad in this city and a steady procession of the cars passes the public square. While most of them do not show the newness and brightness of those on roads in some other cities, the skillful manner in which they are handled shows the good results of experience. Neither trainmen, passengers nor pedestrians seem to be afraid of them. A prominent city official expresses the opinion that the public have to be educated up to the new method of travel, and that the killing of a person now and then is a necessary part of the educational process. The Cleveland roads seem to have outgrown the necessity of the fostering care of construction companies and are running by the strength of their own intelligent grasp of the practical details of the business.

The East Cleveland Road was one of the pioneers in the business, having commenced with the Bentley-Knight system. It is now using the Sprague system with various improvements and additions made by the electrical engineer, Mr. C. W. Wason, who is a nephew of the celebrated car builder of Springfield, Mass., and an uncommonly efficient superintendent. He has entire control of everything pertaining to the mechanical and electrical departments of the road and has nothing to do with other departments. Being free to devote himself to the construction of the plant and to its mechanical operation, he is able to give that part of the work his best attention and has made it a decided success. The company now has 35 miles of road in operation, with 58 motor cars running, and will soon open a new section of 10 miles with 20 additional cars. The single trolley system is used exclusively. The trolley lines are divided into sections of from two to three miles for convenience in testing and to avoid stopping the entire road in case of a break. Feeder wires in some cases run five miles from the power station. One of the important features in the construction of this road is the return circuit. All the rail joints have wire bond connections and along each rail there is placed a No. 4 Stubs gauge wire, soldered to the bonds, while between these two wires a No. 3 wire is run zigzag and connected to them. Lightning arresters invented by Mr. Wason are used in the station and along the line at intervals. These arresters are made with four fusible wires carried by a brass bar, which is hung on a pivot and so arranged that when one wire is burned by lightning, the next one falls into place and keeps the circuit closed. It has frequently happened that three of these wires were burned in quick succession, but the fourth one has always saved the apparatus from damage. The power house of this company is exceeding well arranged and is a model of cleanliness, order and efficient operation. It has seven 150 horse-power boilers, four of which are sufficient for ordinary service; three Armington & Sims' engines of 125 horse-power each, and three of 250 horse-power each; six Edison generators of 80,000 Watts capacity, and six of 40,000 Watts capacity. The expenditure of coal, which costs $1.10 per ton, is four pounds per horse-power per hour. It is the intention of the managers of the company to organize an independent power company to supply current for this and other roads and for any other purposes desired. Some of the cars are equipped with air brakes, which greatly increase the facility with which they can be controlled. The company has extensive shops in which cars are built and repaired. All the rewinding of motor coils is done and other repairs to motors are made here. The cars are run through the shop on every trip and thoroughly inspected and thus kept in good order. By the use of a hydraulic jack and a suitable crane, the motors can be quickly taken out of the trucks and swung to any desired place for repairs. The experience of this company is decidedly against the use of cars of more than one system on a road, for the reason that the multiplication of parts of machinery would add greatly to the difficulty and expense of making repairs.

The Broadway and Newburg Road also uses the Sprague system, having 24 motor cars running. The present road is ten miles in length and the company has nearly completed ten miles additional. It has ordered one Westinghouse car for trial and if it proves satisfactory, the new line will be fully equipped with that style of car. The power is furnished by three 80,000 Watt-Edison generators, each driven by a 125 horse-power engine. Engineer Stanley, of the Brooklyn Company, follows Wason's plan of rewinding and repairing motors in his own shop.

The Thomson-Houston Company is in the field with splendidly equipped power stations, motor cars and lines on the system of roads belonging to Tom Johnson. It hardly seems worth while to waste adjectives and printers' ink in repeating descriptions of the well-known superior construction of this company.

The Short Electric Railway Company is building a track from the Brush Company's factory, where all its manufacturing is done, to connect with the various city street car lines, and will soon have the handsomest palace street car in the country to exhibit to prospective purchasers, and to give its friends pleasant excursion trips through interesting portions of the Forest City. President Sidney S. Short is busily engaged superintending the construction of motor cars and getting them shipped to fill numerous orders. The company to-day received an order for 10 cars for the new road at Indianapolis, described in a recent letter, and shipped two of them on 24 hours' notice. The balance are to go in a few days. The outfit for the Cincinnati and Covington Road, consisting of eight motor cars and three 65,000 Watt generators, is all ready and waiting for the completion of the track across the Ohio River bridge. The company is now shipping machinery for the road at Rochester, N. Y. This will require eleven 125 horse-power generators and 102 motor cars. The Rochester plant is to be doubled next year, and, when completed, will have 60 miles of road in operation. Another road which is being equipped by the Short Company is the one belonging to Tom Johnson, at Johnstown, Pa.

The Wenstrom Motors are being brought to the front by H. H. Hosford, who has just taken the agency for them and who proposes to introduce them for railroad work.

A Reasonable Condition of Harmony exists between the street railway companies and the telephone company, due largely to the diplomatic management of President McKinstry of the latter company. The street car lines have caused a good deal of disturbance to the telephone lines, which has in some measure, been overcome by the use of return telephonic circuits and the removal of telephone wires from dangerous localities, the expense of which the railway companies have paid.

The Chief of the Fire Department, while favoring the extension of electric roads, finds serious objection to the heavy feeder wires placed along the curb lines of the streets, just where they are most in the way of firemen when they attempt to erect ladders or carry their hose into the upper portions of buildings. He is quite convinced that the electric current used by the railroads is deadly, because he once saw a man killed by a Holtz frictional machine. He is very certain that if a little hand machine like that can produce such fatal effects, there would be no hope for a man who got hold of one of these big dynamos.

One of the Most Novel Things in the way of street car propulsion is the plan of a man who lives near Mr. Brush and who has evidently caught the inspiration of his inventive genius. He is preparing to propel a car by an electric motor operated by current from a storage battery, the latter to be continuously charged by a dynamo carried on a car and driven by the wheels of the car when it is in motion.

One of the Daily Papers has for a long time been making a severe onslaught on electric street cars as being very dangerous and otherwise objectionable. The editor of the paper owns property along the line of one of the companies which has somewhat depreciated in value since the road was opened and this is said to be the cause of his hostility. The opening of these roads has afforded easy access to suburban property which is more desirable for residences than property in the heart of the city and the latter has, under an evening-up process, temporarily declined in price.

The Cleveland Telephone Exchange, one of the earliest to commence business and one of the best managed, is making its way successfully, but President McKinstry has not yet reached the point where he can enjoy himself in idleness and let the business run itself. His jurisdiction extends over a considerable part of the Northwest and also of the Southwest, and those wide-awake localities furnish him abundant occupation. The interference of street car lines is the serious difficulty he has to contend with. His experience with the use of a common return wire for a number of telephone wires is similar to that of other telephone managers, that it somewhat relieves, but does not remove, the trouble.

Superintendent Wright, of the Western Union Telegraph Company, has been at his post so long that one expects to find him grown to be a venerable gentleman, and it is always a surprise to see what a young and sprightly man he is. The title of "old timer," as applied to most of the early telegraphists, sounds very much like sarcasm.

Another Man, old in telegraphy, but young in years and activity, is John Thomas, of the Pennsylvania Railroad Company. He and Augustus G. Davis, of Baltimore, were the first operators, messengers and line repairers at Poughkeepsie, N. Y. Both of these gentlemen are relatives of Professor Morse.

One of the Pleasantest Interviews of all this trip was with J. H. Wade. Nearing four-score years; engaged in active, every-day business; carrying large responsibilities; still the same unassuming, courteous, genial friend, with time for every one who called. Long years and diverse interests had not changed his love for the old business and "the boys." He inquired after many of them, expressed a wish that he might meet with them at the coming reunion, and now, as this is written, he is "gone away." The memory of no man who ever touched a key should be more tenderly cherished. G. C. M.

Cleveland, O., August 10, 1890.

PERSONAL.

Messrs. Alfred Stevens, of London, managing director of the International Okonite Company, Thomas Connolly and Thomas Connolly, Jr., of the Shaw & Connolly Wire Company, Manchester, England, are spending a few weeks in New York City.

J. P. McKinstry, general manager of the Erie Telephone and Telegraph Company, J. K. Dunbar, of the same company, and G. W. Foster, of Texas, favored the REVIEW with a call last week.

The St. Louis Electrical Exposition.

(By Telegraph to the ELECTRICAL REVIEW.)

ST. LOUIS, September 5th, 1890.—Sixteen thousand people witnessed the opening of the second annual Electrical Exhibition, at St. Louis, on Wednesday evening, September 3d, and declared it an unqualified success. Some of the exhibits were very elaborately displayed, while others were delayed by reason of the inability to get them out of the perplexing tie-up on the railroads.

There are electric fountains and cascades, and all sorts of electrical novelties in profusion.

The following is a list of companies which now have their exhibits in place; more are *en route:*

Carpenter-Nevens Electric Heating Co., Minneapolis.
Russell Arc Lamp Co., Boston.
St. Louis Electrical Supply Co., St. Louis.
Washington Conduit Co., Washington, D. C.
Johnson Electric Train Signal Co., Boston.
James W. Queen & Co., Philadelphia.
Automatic Electric Clock Co., Syracuse, N. Y.
Southern Electrical Supply Co., St. Louis.
Turner Electric Elevated Railroad, Dallas.
Kester Electric Co., Terre Haute, Ind.
Crocker-Wheeler Electric Co., of New York.
Union Electrical Co., St. Louis.
Great Western Electric Supply Co., Chicago.
Simplex Electric Co., Boston.
Bernstein Electric Co., Boston.
Parker-Russell Mfg. Co., St. Louis.
Joseph Irwin, Omaha.
Shultz Belting Co., St. Louis.
Page Belting Co., Concord, N. H.
Washburn & Moen, New York.
Sperry Electric Co., Chicago.
The Thomson-Houston, Westinghouse and Edison Electric Light Companies are all exhibiting.
John T. Noye Engine Co., Buffalo.
Connecticut Motor Co., of Plantsville.
Okonite Co., of New York.
Shay, Stephens & Co., Chicago.
Armington & Sims, of Providence.
Russell Engine Co., Massillon, O.
Buckeye Engine Co., Salem, O.
Swan Lamp, Cleveland.
Foree Bain, Chicago.
National Electric Mfg. Co., Eau Claire, Wis.
Hooven, Owens & Retchler, Hamilton, O.
Kelly Lamp Co., Rochester.
Western Electric Co., Chicago.
Municipal Signal Co., Boston.
Burton Electric Heater Co., Richmond.
Leclanche Battery, New York.
N. P. Edgerton, Philadelphia.
Gibson Electric Fixtures and Dekosenko & Hetherington Sons, Philadelphia.
River and Rail Electric Co., New York.
Waite & Bartlett, New York.

The exhibit is a big one and will be largely attended. W.

A New Broadway Hotel.

On the evening of September 1st, the new and beautiful Hotel Imperial, Thirty-second street and Broadway, was thrown open to the public by its proprietors, Stafford and Whittaker.

The beauties of the structure have been described in the daily press, but were it not for the excellent illumination, many handsome effects would be lost. The electroliers and minor fixtures are by the Archer and Pancoast Manufacturing Company, of this city. Rare judgment and good taste have been exercised, both in the designing of the fixtures and in their advantageous disposition. No shadows are cast, the light being well diffused, and producing a mellow glow effect.

The hotel is provided with its own electric lighting equipment, the plant consisting of two United States compound wound 800-light dynamos, and two 100 horse-power Westinghouse standard engines. The dynamos are belted directly to the engines. The building is wired for 2,000 lights, the wires being run entirely in the Interior Conduit and Insulation Company's tubes.

A most complete system of electric signals and calls has been installed by Dr. Herzog, of this city.

The Erie Telephone Company's subdivisions made a net gain of 50 subscribers in July, and a net gain in earnings of $5,500 over the same month last year.

Telephonic News

*** A fire in the cellar of the Indianapolis telephone exchange did $1,500 damage.

*** The New York and New Jersey Telephone Company is to erect a building in Brooklyn, to cost $26,000.

*** Until lately the German Post Office had the sole right of erecting or licensing private telephone installations, thus prohibiting the development of a most convenient means of communication, and excluding the legitimate industry from a branch which ought to be its domain. The well known telephone manufacturing company, Actien Gesellschaft Mix & Genest, Berlin (whose branch in London is the International Electric Company, 34 Aldermanbury, E.C.), determined to try the point in a court of law. To this effect they brought an action against the German Government claiming that: "It (the German Post Office) had no right to restrain or prohibit the plaintiffs to erect and maintain private telephone installations (*a*) between buildings belonging to the same landlord but situated at a distance from each other, and separated by property of other land owners or by public roads or otherwise; (*b*) between property belonging to different landlords—*i. e.*, from one part of a city to another." This claim was decided on the 10th of July, in the Royal High Court of Justice (Königliches Landgericht I), of Berlin, entirely in favor of the plaintiffs, thus putting an end to a state of things which has lasted too long, says the London *Engineer*, to the disadvantage of all those interested in this daily progressing industry.

Instructions for the Use of the Telephone.

If you have a telephone in your office or store, ring up "Central" and then go and wait on a customer. Pay no attention to the bell when "Central" rings back, but go to the telephone in about 15 minutes, ring up again, and make a kick if the operator is not there waiting for you.

Always speak in an undertone, in order to make "Central" ask you over what you said. If she does not hear you, tell her to "wake up," or "take the cotton out of her ears." She will then admire your originality, for she does not generally hear that advice more than 40 times a day.

Put your "plug" in before a storm, and be sure not to take it out again, but go around to the central office and offer to lick the whole telephone company for neglect of duty.

Take your time in answering your bell, or, what is better, do not answer it at all, but in about half an hour ring up and ask who called you, and get mad if "Central" has forgotten who it was. She has nothing else to do but remember.

Always ask "Central" to transfer the message for you. She likes to do this, as it helps to kill time for her.

Allow everybody who wants to to use your telephone. Hang the receiver big end up, as in this way it gets full of dust, which makes another cause for complaint.

Bang on the transmitter with a lead pencil, as though you intended to knock it through the wall. This invariably makes it talk better. Refuse to pay toll messages, and if you are on a line with someone, always listen to their conversation, and be sure to want to use the line while they are doing so.

Whenever you see the manager, tell him that if he cannot give you a better telephone or get that one fixed, you will throw the whole thing out of the window. When the inspector comes, deny that you have ever complained of the telephone and that it works like a charm.

Lastly, kick against everything, and cause as much trouble for the company as you can. They are delighted to have you do so, otherwise business would be monotonous.

Paste this on your telephone for future reference.

The National Telephone Exchange Association.

The twelfth annual meeting of this association occurs at the Russell House, Detroit, this week, and will be in session two days, Tuesday and Wednesday. Delegates are requested to register promptly at the Secretary's office on arrival in Detroit, in order that it may be known who is present, and that an accurate roll of the meeting may be prepared. The badge of the association will be the same as last year, and delegates who have preserved the little nickel button which proved so useful last year in "deadheading" telegraph messages, are requested to bring them to wear at this meeting.

The following are the officers of the association, the terms of all of whom, with the exception of the first two members of the advisory committee will expire at this meeting:

President, William D. Sargent, Brooklyn, N. Y.

Vice-President, Frank G. Beach, Chicago, Ill.

Secretary, C. H. Barney, New York City.

Treasurer, H. L. Storke, New York City.

Advisory committee, for three years, vacancy (George N. Stone, elected last year, having resigned); for two years, Morris F. Tyler, New Haven, Conn.; for one year, Edward J. Hall, Jr., New York City.

Executive committee, William D. Sargeant, *ex-officio*, Brooklyn, N. Y.; Charles F. Cutler, New York City; Charles H. Wilson, Chicago, Ill.; H. N. Gifford, Louisville, Ky.; Levi Sprague, Lowell, Mass.

The Detroit Telephone Company will furnish the entertainment for the visitors, consisting of carriage ride and lunch, at Belle Isle Park Casino, Wednesday at 2:30 P. M., and banquet at the Russell House in the evening. On Thursday, boat ride and lunch on board.

Phenomenal Telephoning.

Things are done pretty thoroughly under the supervision of Chief Walker and Manager John C. Sager. A day or two since, some workmen in making a connection between street pipes and those in a dwelling house near the residence of Director Stokley contrived to break the underground telephone wires between that point and the City Hall.

Inspector Burke went to the Director's recently to report upon the way in which the hands sent to repair damages had performed their task. A new length had been put in and the wire was again in operation. Mr. Burke called up the main office and Manager Sager went to the telephone to talk with him. The apparatus was at the further end of the room and Chief Walker sat looking over the afternoon papers on a sofa within a few yards of the front windows, and certainly not less than 30 feet away from the instrument.

Mr. Burke asked, through Manager Sager, a question of Chief Walker which the chief answered, elevating his voice slightly. Mr. Sager was about to repeat the answer to the Inspector when the latter said, over the telephone: "I heard him."

"What?" exclaimed Mr. Sager, "heard the chief's reply?"

"Heard every word he said," Mr. Burke answered from Broad and Norris streets. The chief had some further talk with him, still keeping 30 feet away from the telephone, Mr. Burke answering through the transmitter to Mr. Sager, but hearing directly every word spoken by Chief Walker, though at so great a distance from the instrument. The chief's countenance wore a smile of satisfaction.

"That is pretty good evidence," said he, "that underground wires will work."

Manager Sager explained that while they were using the ordinary Bell telephone, the difference in distinctness of enunciation was altogether due to the superior insulation of the wires, the bureau using the Standard system, while the wires in general use are wrapped only with paper under the lead, instead of saturated cotton fibre.—*Philadelphia Inquirer.*

The marriage of Mr. B. F. Merritt, the electrician of the New England Printing Telegraph Company, to Miss Alice Walker, took place at Jamaica Plain last Wednesday. After a tour, which will include Niagara and the Catskills, Mr. and Mrs. Merritt will reside in Jamaica Plain.

An Account of Some Experiments Upon the Application of Electrical Endosmose to the Treatment of Concretions.

PAPER READ AT THE INTERNATIONAL MEDICAL CONGRESS, BERLIN, AUGUST, 1890, BY DR. GEORGE BAYLES, ORANGE, N. J.

Having ascertained that gouty concretions are in many cases treated medically with the lithium salts taken internally, with the object of causing urate of lithium to be formed, dissolved and excreted from the body; and being also informed that the difficulty met with in the treatment was in ensuring that the salts so administered should be absorbed into the system, it occurred to me that perhaps more rapid success might be obtained if the application were made externally, employing the well-known principle of electrical endosmose to carry the lithium into the tissues. This method of operation appeared to offer considerable hope of success, because the lithium would be brought directly into the neighborhood of the concretions, and would thus be more likely to act promptly.

Electrical endosmose, as the name implies, is that property of an electrical current passing through a porous diaphragm between two solutions, by virtue of which one solution is mechanically transferred across the barrier. The current seems, in fact, to accelerate the diffusion which always takes place between solutions separated by a porous diaphragm, and at the same time acts only in one direction, the solution being carried from the positive to the negative pole, from the anode to the cathode. A full description of the phenomenon is given in Wiedemann's "Die Lehre von der Elektricitat."

To test the possibility of lithium salts passing through an animal membrane, I made the following experiment:

A glass funnel of 7.5 centimeters diameter at aperture was closed by a piece of sheep bladder 0.012 centimeters thick, thus providing a porous diaphragm of 44 square centimeters area. This funnel was inverted and filled with slightly acidulated water, and a platinum wire passing down the tube formed the negative electrode. The whole was then immersed about one centimeter below the surface of a two and one-half per cent. solution of lithium oxide, contained in an evaporating dish, above the bottom of which it was supported about 1.25 centimeters. Immediately after the immersion a second platinum wire, forming the positive electrode, was dropped in the dish, and a current of 150 milliamperes sustained steadily through the apparatus for 75 minutes. The funnel was then removed and emptied. Its contents were mixed with napos (sodium phosphate) and the mixture was evaporated to dryness. The residue was then treated with water to dissolve the sodium salt and the residue left for 12 hours. The final precipitate was found to contain 0.5 grammes of lithium phosphate.

The experiment was then repeated under precisely similar conditions, except that no current was passed through the apparatus, and diffusion only could be active in transferring the salt. The analysis in this case showed that 0.3 grammes of lithium phosphate was present, from which it was presumed that in the previous instance the current had increased the diffusion transfer to the extent of 67 per cent.

Finding the experiment to succeed with a membrane. I next tried whether a healthy man, after being subjected to such a course of treatment as a patient suffering from concretions might be expected to undergo, would not give indications of the absorption of lithium in his excretions. In October, 1889, J— D—, an active, healthy laborer, aged 20, and 140 pounds weight, was operated upon in my laboratory. He sat in one chair and kept his hands immersed to the wrists in glass jars, one containing a solution of two per cent. lithium chloride, with a platinum electrode forming the positive electrode, and the other containing a solution of common salt with the negative electrode. The current passed through him was four milliamperes, which was as much as he could conveniently stand. This treatment was continued for about two hours daily during one week, the time total amounting to 11 hours. His urine was collected during the week and tests were applied to it. Using a particular spectroscope and method, it was found that a solution containing a $\frac{1}{20000}$ part by weight of lithium chloride in water was just detectable by a faint red band in the spectrum. No such band could under these circumstances be discerned from the urine itself, but a concentration of all the week's urine reduced to the form of a chloride gave a distinct band. An evaporation of two-fifths of the total quantity of this liquid yielded on analysis 0.22 grammes of lithium chloride, and it was, therefore, presumed that the whole amount of salt excreted, 0.55 grammes, corresponding to 9.09 grammes of metallic lithium, or equivalent to the removal of 2.43 grammes of uric acid.

I next tried the application to a patient suffering from an acute and typical form of the malady, in December, 1889. This person volunteered to try the effects of the method. He was 73 years of age and had lived an active healthy life until ten years previously, at which time, according to his own statement, he contracted the disease through sleeping in damp sheets. Concretions commencing, continued to increase slowly, until they assumed large proportions. All the joints, except the knees were much enlarged by atheromatous concretions. A certain degree of venous congestion was visible in the face, and incessant pain had supervened in various parts of the body during the last few months, apparently from the pressure of the calculi upon the nerves. The joints of the fingers were almost obliterated by concretions. The girth of the little finger of the left hand was, by careful measurement, 8.6 centimeters, that of the corresponding finger of the right hand even greater. There was great weakness and difficulty in walking, but the mind was clear and intelligence unimpaired.

Treatment was commenced in the manner above described. The current generated from my laboratory 120 volts dynamo, passed through about 5,000 ohms resistance, and entered a jar containing an aqueous solution of lithium chloride, density 1.08, in which the patient immersed his left hand up to the wrist. His right hand was similarly immersed in a solution of common salt. The current, after passing through his body, left the latter jar by a negative electrode. It was found that he could stand 20 milliamperes without inconvenience, and this strength of current was steadily applied for six days, during four hours daily. At the end of that time the girth of the left hand little finger had distinctly reduced to 8.2 centimeters; the patient also experienced freedom from pain after the first day's treatment. He continued the treatment during the week following, and then the journeys to and from the laboratory exhausted his strength.

The finger girth after 14 days from the date of commencing treatment was 8.0 centimeters, a total reduction of 0.6 centimeters in this particular finger, whose form facilitated accurate measurement, and the general condition was temporarily ameliorated.

From these experiments, I think it fair to conclude that satisfactory use can be made of the principle of electrical endosmose in such cases.

A Deserving Gentleman Complimented and Vindicated.

[From the N. Y. *Herald.*]

Mr. Patrick Farrelly is one of the most respected citizens of New York and at the head of an immense business—the American News Company. Yet he is now under bail for $1,000 to appear for trial on the charge of disseminating immoral works.

We take it for granted that Mr. Farrelly has never read one of the books referred to, and could not be induced to. He is a busy gentleman and sends out multitudes of printed things every day. To read or even scan them is physically impossible.

Among the works for which Mr. Farrelly is to be tried for selling is a novel by Balzac. Well, Balzac was one of the great minds of the century, and his works are classic. If Mr. Farrelly is to go to prison for selling Balzac's writings, how about the other publishers, who sell Rabelais, Tristram Shandy, the works of Byron, Moore and Fielding? Why may we not see some morning a procession of booksellers, headed by the venerable Harper Brothers, marching to the Tombs? Why may there not be a Bookseller's Row, as there is a Murderer's Row?

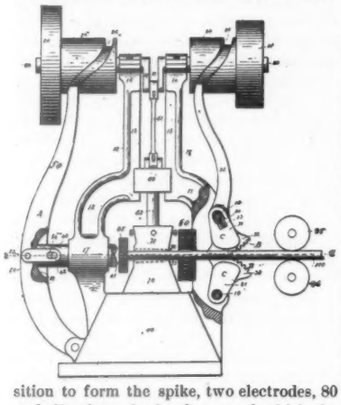
With all seriousness, however, we think the arrest of Mr. Farrelly an outrage. Here is an honorable, respected gentleman, who would no more knowingly circulate an improper book than poison his coffee or his wine. Yet he must give bail like a pickpocket for having among the thousands of publications sent to his care a novel of Balzac. We have had too much of this meddling business—rummaging the mails for the books of a conscientious writer like Tolstoi, suppressing the poems of one of the gentlest and noblest of writers, Whitman, and now taking a gentleman to the Tombs for having on his shelves a copy of Balzac. American readers are not children, idiots or slaves.

The Short Electric Railway Company has recently received an order for a large number of cars from the Citizens' Street Railroad, of Indianapolis, Ind. Within two weeks after the order was given several of these cars were put into operation upon the line, the order being filled with greater promptness than any thus far received by the electric railway companies.

RECENT IMPORTANT ELECTRICAL PATENTS.

THE BURTON ELECTRIC SPIKE-FORGING MACHINE.

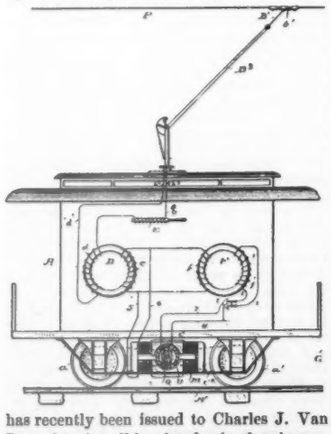
In the accompanying engraving we illustrate an electric forging machine for making railroad spikes, bolts, coupling pins and similar articles, the invention of George D. Burton, of Boston, Mass. The machine comprises a bed-plate upon which is mounted an anvil, 70. A plunging die, 71, adapted to shape the body of the spike and provided with an edge, 73, adapted to cut off the spike simultaneously with the forming of its body, is reciprocated by means of a pitman and crank operated by a pulley, 21. The rod of metal, 100, from which the spikes are to be forged, is fed forward to the shaping dies by feed rollers. The moment the bar of metal is pushed into the proper po-



sition to form the spike, two electrodes, 80 and 85, through the former of which the bar extends, complete an electric circuit carrying a current of very great volume or heating power. Two cams, 23 and 24, operated by the crank shaft, oscillate levers, 35 and 50, and are so disposed as to throw these levers to the right when the die, 71, is being raised from the spike. The lever, 35, operates two gear sectors, 32 and 33, intermeshing with each other, and causes two jaws, *C C*, one of which is mounted in a yielding bearing, to grip the rod from which the spike is being formed. The other lever, 50, simultaneously with the gripping operation just noted, forces a plunger, 40, hung upon a link so as to permit it to reciprocate in a fixed bearing, 17, to swage the head of the spike, the electrode, 85, which closes the electric circuit, being forced rearwardly from contact with the spike by means of a cam, not shown in the illustration, when the plunger, 40, approaches closely to the end of the rod, 100. The heavy current of electricity applied to the end of the metal rod enables the spike to be formed very readily with a moderate blow.

ALTERNATING CURRENT ELECTRIC RAILWAY.

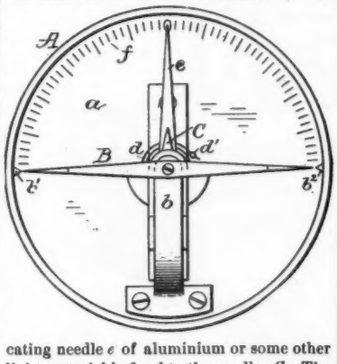
In the accompanying engraving is illustrated an electric railroad system operated by alternating currents for which a patent



has recently been issued to Charles J. Van Depoele. A well insulated pair of main conductors is supported overhead and connected with an alternating current generator at a terminal supply station. The motor car is provided with a contact arm carrying two current collecting trolleys which take the current from the two overhead wires. This current is led through the primary circuit $d\ d^1$ in the engraving, in which is interposed a reactive coil *E* by the regulation of the core of which the strength of current circulating in the primary circuit of the transformer *D* may be varied. A secondary coil *e* on the transformer *D* is connected with a primary coil *f* of a second transformer *F* and the secondary circuit of this latter transformer is connected through a reversing switch with the armature of an alternating current motor which drives the car. The secondary coil *e* of the first transformer *D* discharges into the field-magnet coils of the alternate current motor. It is designed by means of the two transformers *D F* to produce a difference of current wave phase in the two circuits 5–6 and 7–8, supplying the armature and field-magnet circuits of the motor, and thus develop a rotary torque in the manner usual in alternating current motors. By the adjustment of the core of the reactive coil *E* the speed of the car may be determined, as such adjustment regulates the strength of current flowing in the primary of the transformer *D*. The difference of phase in the two motor circuits, both of which carry currents of low potential, is produced by means of the second transformer *F*.

A DEVICE FOR MEASURING THE INTENSITY OF MAGNETIC CURRENTS.

In the accompanying illustration is shown an instrument for measuring the strength of magnetic currents, invented by Rudolf Eickemeyer. The device comprises two independently pivoted needles, *B* and *C*, the former of which is made preferably of aluminium tipped with short sections of iron at its extremities. The needle, *B*, is free to swing upon its pivot in any direction, but the needle, *C*, is held under tension by a light coil spring *d*, one end of which is fixed to the needle or its axis, and the other end to the frame of the device. An auxiliary indi-



cating needle *e* of aluminium or some other light material is fixed to the needle, *C*. The case, *A*, which is made of some non-magnetic material, is provided with two fixed points, $b^1\ b^2$, with which the needle, *B*, should be brought in alignment in taking an indication. When the device is brought near a magnetic field the needle, *B*, will place itself in alignment with the lines of force, and the needle, *C*, will have a tendency to do the same, but being held under tension by the coil spring, it will be deflected to a degree proportional to the strength of the magnetic field. After the needle, *B*, has assumed its position under control of the lines of force the case is revolved until the points, $b^1\ b^2$, come in alignment with the ends of the needle, *B*, when the angle indicated on the scale to which the finger, *e*, has been deflected from the zero point will show the strength of the magnetic field. In calibrating the scale a field of force is created having a definite number of lines of force per square inch. The instrument is then placed in this field and the deflection noted and marked. The electric current is then increased and the deflection due to the increased number of the lines of force indicated and marked, and this operation is continued until the measuring capacity of the instrument has been reached. The instrument is designed for use and will probably find its greatest value in exploring external magnetic fields of dynamo-electric machines, in order to determine their direction and strength and thereby ascertain the amount of magnetic leakage in the machines.

The Resistance Offered by Gases in a Magnetic Field.

BY A. WITZ.

The first results which I had the honor to submit to the Academy relating to the action of magnetic fields on Geissler tubes required completion; indeed, after having studied the effects produced by a variation of the strength of the field, and also by a variation of the position of the tube with respect to the lines of force in that field, the effect produced by an alteration in the pressure of gas in the tube was still undetermined.

The following experiments have been made in a glass cylinder two centimeters in diameter, provided with taps and adapted either for compression or rarefication of the gas contained in it. The discharge oscillated between two electrodes provided with cones of aluminium. Under a pressure of 0.6 centimeter of mercury a purple discharge was obtained; with 230 centimeters a brilliant and powerful spark formed a path of fire between the two points. For intermediate pressures a spark and a discharge were observed simultaneously.

Now the effect of the magnetic field displays itself under these varying conditions in different ways. The discharge is diverted in accordance with the laws of electro-dynamics, the spark, however, is not; the effect then should be considerable for low pressures, whilst it should be eliminated at high pressures.

It was only a question of testing the exactness of these inferences. The following are the results obtained by experiment:

Experiment.	Outside the field.		Within a field of 7,200 units.	
Pressure in cubic centimeters.	Currrent in milli-amperes.	Difference of potential in volts.	Current in milli-amperes.	Difference of potential in volts.
0.607	5.86	976	3.91	9,787
32.446	4.66	2,815	2.75	5,857
74.610	2.79	4.669	2.04	4,719
76.020	3.50	5.544	2.05	6,919
114.310	2.33	8,058	1.44	8,097
155.51	2.16	8,731	1.27	9,487
230.1	1.42	12,028	0.74	12,589

At the very low pressure of 0.6 centimeter the potential difference becomes 10 times larger, but there is no variation worth mentioning at 3 kilogrammes pressure. I think I am justified in concluding from this that the magnetic field only effects the magnetic discharge. The influence of the electrical field, which is so great in a Geissler tube, depends, therefore, on the constitution of this tube, and the state of rarefaction of the gas enclosed in it; and no effect is produced by it on gases in free space.

This gave a valuable clue to the analysis of the very complex phenomena observed in the Geissler tubes. The similarity of the effects produced by a magnet, and the approach of a metallic conductor (or even a finger) lead me to suggest a new explanation of these phenomena. That there is a striking similarity may be gathered from an example. A tube containing fluoxide of silicium gave me the following results:

Outside the field.		Near a mass of iron.		Within a field of 11,570 units.	
Current in milli-amp.	Diff. of potential in volts	Current in milli-amp.	Diff. of potential in volts.	Current.	Diff. of potential.
1.500	2,434	1.16	3,185	.99	5,730

It is true that these effects vary with the nature of the gas, the shape of the tube, the pressure, etc., but they can nearly always be verified on tubes in the sensitive condition. The phenomenon is sufficiently general to admit of the action of the magnet being ascribed to a change in the electric capacity of the Geissler tubes; these tubes, therefore, are really condensors, and their illumination is the result of an oscillatory discharge, similar to that of a Leyden jar, of which the period T is a function of the capacity C of the jar, and of the coefficient L of self-induction of the conductor, assuming the resistance to be very small, for $T = \pi \sqrt{C\ L}$. A change in the capacity C will vary the vibratory condition of the gas, and would be the origin of the differences observed in the luminous phenomena in a strong magnetic field.

TELEGRAPHIC

.... The New England Printing Telegraph Company is building a line between New York and Boston at the rate of two miles per day.

.... The Stock Quotation Telegraph Company, of New York, has filed in the office of the Secretary of State at Albany a certificate of a reduction of its capital from $1,000,000 to $250,000.

.... The Associated Press has given instructions to its telegraph operators to learn the manipulation of the typewriter, as it is found that this instrument materially increases the speed of receiving messages.

.... The process of tearing down the burned portion of the Western Union building proceeds with alacrity. A large force of men under competent supervision is at work. It may be some time before the upper part of the building is finished. When it is completed, however, it will be practically fireproof and more conveniently arranged than before.

The Influence of the Telegraph on Diction.

Somewhere I read, long ago, that the ever-growing practice of telegraphing was undermining the grammar and the literature of America. Though I believe that the literature of America, especially of the United States, is but just begun—barring, of course, some notable instances in the earlier history of our country, I candidly confess that in the very nature of the brevity of telegrams there is something which tells against pure diction and sound grammar.

I was in receipt, only last week, of a letter from a well-known editorial writer on a New York newspaper. The language of telegraphy was as easily discerned as though the epistle had been written on a Western Union blank. "Yours received." "will write again," "am not sure of phraseology," "Huxley mentions same," are some of the expressions this well-trained writer allowed to slip from his pen.—*Jewish Tidings.*

Telegraph Poles for Advertising Purposes.

A Melbourne (Australia) paper says "there is every reason to believe that an arrangement will be entered into whereby the present unsightly wooden poles which support the street telegraph wires will be transformed into advertising hoardings, with due regard to the æsthetic cravings of the pedestrians. It is claimed that no damage will be done to the property of the Post Office, and that, while the City Council will take proper precautions to prevent the impeding of traffic, the advertising company will substitute symphonics in gold, pink and azure for the black tar besmirched posts, whose ugliness is but hardly excused, even on utilitarian grounds." On reading the first few lines we were struck with horror, says the London *Electrical Review*, to think what such a similar arrangement might do for our English towns, for although it is conceivable that harmonious designs by Burne Jones, Edward Poynter, Walter Crane, Whistler and others, might prove interesting, nay, even instructive to art lovers among the public, yet we fear that in but too many cases color and form would be sacrificed to give prominence to the commercial aspects of the announcements. Telegraph poles, at any time, appear as defects in a landscape, but transformed into "advertisement hoardings," they would be simply atrocious, unbearable. Happily, however, there is not much fear that our Postal Department would be a party to such an arrangement as that indicated above, even though importuned to be so.

* * There is talk of introducing electricity into the street car system of Allentown, Pa. The change would cost about $50,000.

* * Lansing, Mich., is happy. Its new electric street cars have been tested and the Westinghouse equipment is most satisfactory.

* * It is stated that over 40,000 passengers at penny and twopenny fares have been carried in the electric launches at the Edinburgh Exhibition.

* * The Brooklyn City Railroad Company has decided to build an electric railway on Second avenue. The road must be in operation December 1 to save the charter purchased from the South Brooklyn Terminal Company.

* * Judge Maggie, at Newark, N. J., on September 2d, refused to grant an injunction staying the further erection of overhead electric motor wire posts, but granted a rule requiring the company to show cause why it should not be granted.

* * The Sioux City Electrical Supply Company report the sale of nearly $4,000 worth of Hawkeye motors in their territory the past month. Among the novel uses, a five horse-power will press old rags into bales at Des Moines, and a three horse-power will cut corn for decorating the Sioux City Corn Palace.

* * In a conversation relating to electricity, recently, President Lewis, of the Brooklyn City Railroad Company, said that the prevailing idea that electric motors were dangerous was entirely erroneous. Letters from the Mayors of 64 cities where they were used proved this. Moreover, it was an eminently satisfactory mode of locomotion.

* * The Connecticut Motor Company, of Plantsville, Conn., have just concluded arrangements whereby Mr. F. O. Rusling is to become their special agent. Until recently Mr. Rusling has been connected with the construction department of Thomson-Houston Company, and his many electrical friends may be congratulated upon a change which will enable them to see more of him in the future than they have in the past.

* * Mr. Fred. W. Horne, of the Thomson-Houston Railway Department, is being congratulated by his friends on securing the contract for the Davenport, Rock Island & Moline Electric Railroad. This contract amounts to over $300,000 and is one of the largest that has been let in Chicago. The Central Electric Company, of Chicago, have secured the order for supplies on this contract. This is probably the largest electrical supply order ever placed in that city, amounting to upwards of $40,000.

* * A few days ago, the Lansing and North Lansing Railway Line, of Lansing, Michigan, commenced operation, and according to all accounts, everything went off with the greatest success. This is a street car company which has adopted the Westinghouse electric railway system, and the officials of the road are very profuse in their praise of the system. A gentleman who was present at the starting of the cars stated that although the motor men were all green hands, the cars ran without a hitch and in a manner perfectly successful. The opening of the line was quite an event in Lansing.

What the Electric Road Proves Nashville to Have.

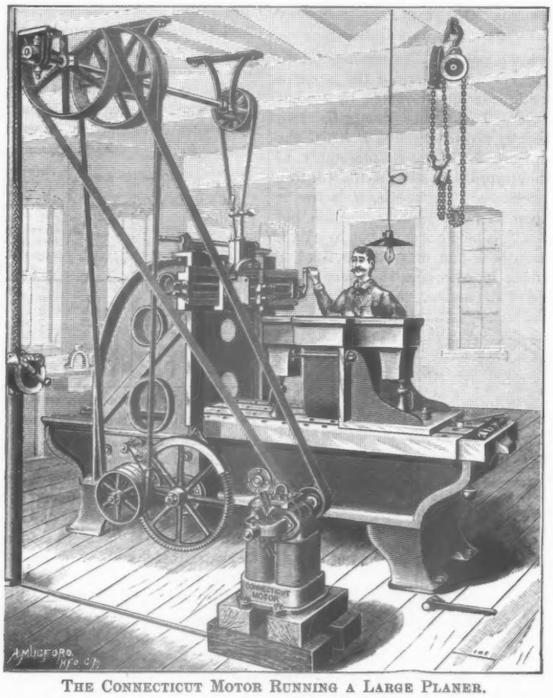
Capt. Stanley H. Bell furnishes, incidentally, a fine point for the thrift and enterprise of Nashville, Tenn. He has been in correspondence with the Thomson-Houston Electric Light Company in regard to traffic on electric railroad lines. They state that the proportion of people carried increases with the signs of the times; that in towns of from 10,000 to 20,000 the number carried is from 10 to 20 to one. By that rule, in a town of 15,000 the number who would ride in a year would range from 150,000 to 300,000. They note as remarkable the statement that a certain city of 50,000 people had 2,500,000 to ride in a year. "But this is an exceptional place, characterized by an energy and activity unusual even in the West."

Note the record for Nashville. It is given out that her electric cars will have carried the present year more than 6,000,000, or more that 80 to one of her population!

A Motor Installation.

Our illustration on this page shows a recent application of a Connecticut motor to a 28x28 fourteen foot bed planer. It is one of numerous instances where the electric motor is superior to steam power in saving power lost in a multiplicity of shafting, or in operating a piece of machinery isolated from the rest of the shop, or in working overtime where it would be a matter of considerable expense to keep up steam.

Mr. R. E. Dunston, of the Connecticut Motor Company, Plantsville, Conn., has prepared the following table, showing the power required in a few of the installations made by his company:



THE CONNECTICUT MOTOR RUNNING A LARGE PLANER.

1. Shop shafting, $2\frac{7}{16}$ inches diameter by 80 feet long, running 160 revolutions and carrying 26 pulleys from 6 to 37 inches diameter, 1.32 horse-power.

2. Lodge-Davis upright, back-geared drill press, having table 28 inch swing, drilling $\frac{3}{4}$ inch hole in C. I., and feeding 1 inch per minute, .78 horse-power.

3. Morse twist drill grinder, 2 inches, carrying two 6 inch wheels, 3,200 revolutions, .29 horse-power.

4. Pease planer, 30x36 inches, table 6 feet, planing C. I., cut $\frac{1}{4}$ inch deep, and planing 6 square inches per minute at nine reversals, 1.01 horse-power.

5. Shaping machine, 22 inch stroke, cutting steel, diameter 6 inch stroke, $\frac{1}{4}$ inch deep, shaping at rate of 1.7 square inch per minute, .37 horse-power.

6. Engine lathe, 17 inch swing, turning steel shaft $2\frac{3}{8}$ inch diameter, cut $\frac{5}{16}$ inch deep, and feeding 7.92 inch per minute, .43 horse-power.

7. Engine lathe, 21 inch swing, boring C. I., hole 5 inch diameter, cut $\frac{5}{16}$ inch deep, feeding 3 inches per minute, 23 horse-power.

8. Sturtevant blower No. 2, at 1,800 revolutions, no piping, .8 horse-power.

9. Heavy planer, about 28 x 28 inches by 14 feet bed, stroke 8 inches, cutting steel, and making 22 reversals per minute, 3.2 horse-power.

Electric Street Railways.

The great objection to the use of the overhead wire has been the fear of serious injury to individuals. On this line of inquiry we have received full information, and find that of the 66 cities from which responses have been received, reports of accidents are confined to 15. Of these only eight have resulted in serious or fatal injuries to human beings, the others being the killing of horses by falling trolley wires, which all the companies admit is likely to occur. Of the human beings killed, in all but two cases the accident was due to other causes than the electric wire, and in both cases, where the wire apparently brought death, they were by electric light wires.

These accidents, summarized, are as follows, and are a remarkable evidence either of the claim made by the electric car company that the electric current is not fatal to human beings, or else of the care taken by them to prevent accidents from occurring by the giving of shocks from the overhead wires to individuals. We have not heard of a single death from the trolley wire.

Nashville, three horses killed; Cleveland ten persons killed entirely by electric light wires; Syracuse, man killed by horse running away; Scranton, one horse killed; Richmond, Va., several horses killed; Newport, slight injuries from telephone wires; Springfield, Mass., one man killed by horse taking fright; Erie, one child run over; Chattanooga, two horses killed by electric light wire; Des Moines, child killed by jumping from car; Tacoma, one person injured by defective brake; Salem, Ore., one man injured putting up trolley wire; Harrisburg, one horse killed; Lima, one man killed from electric light wire; Newton, employé shocked but recovering.—*Boston Advertiser.*

The Iowa Exhibit.

The electrical exhibit at the Corn Palace, Sioux City, Iowa, is going to be one of the leading features this year. Many attractions have already been secured. Electricity will be furnished exhibitors from batteries or 100 or 500 volt constant potential, 50 volt alternating or 10 ampere constant current.

The finest location on the ground floor has been assigned for the electrical displays.

Full information can be obtained from the Sioux City Electric Supply Company.

The Puget Sound Telegraph Company will, in the near future, transfer its lines under a new lease to the Postal Telegraph Company.

A New Electrical House.—Alexander, Barney & Chapin.

It will be a surprise to many of our readers to learn that about October 1st an electrical supply firm, composed of the three gentlemen above named, will commence business in the large store in the Telephone Building, 20 Cortlandt street, this city. These gentlemen, all well-known in the electrical field, have been connected with the Sawyer-Man Electric Company as general manager, treasurer and purchasing agent, respectively.

Mr. P. H. Alexander is to have charge of the selling in the new firm, and is a particularly successful salesman. He has been engaged in the electrical field for many years, beginning with central station work, installing plants, etc., in connection with the business of the Thomson-Houston, Sawyer-Man and Westinghouse Electric Companies. He was appointed general manager of the Sawyer-Man Electric Company, and the phenomenal success of that company in the past few years attests his able management. Outside of the regular work, Mr. Alexander has been interested as president of the New England Insurance Exchange, of Boston, Mass., in harmonizing the insurance and electrical interests in New England. The rules and regulations made by the insurance and electric light men have been a great benefit to the public. Mr. Alexander is now a member of the National Electric Insurance Bureau, which is framing rules for the United States, to be observed by those installing machinery, etc., for electrical purposes. Widely known, and with a varied experience from constant activity, Mr. Alexander is well fitted to be at the head of the firm, the success of which may be safely predicted.

General C. H. Barney began in the telephone business in 1879, resigning for that purpose his position as treasurer of the Providence Gas Burner Company, with which he had been connected for 10 years. After two years experience in Providence and Boston, during which time he constructed the first long distance telephone line between those cities, in December, 1881, he was called to the management of the New Jersey Telephone Company, which position he held until his resignation in 1886, at the organization of the Sawyer-Man Electric Company, of which he is now the treasurer. He was one of the charter members of the New York Electric Club, and is a member of the board of managers of the same. He has been since 1885 the secretary of the National Telephone Exchange Association, which holds its annual meeting in Detroit, on the 9th inst. The General has a large acquaintance with electrical men and is a popular gentleman. As treasurer of the Sawyer-Man Electric Company, he has had experience in the management of finances which will be of value to the new firm.

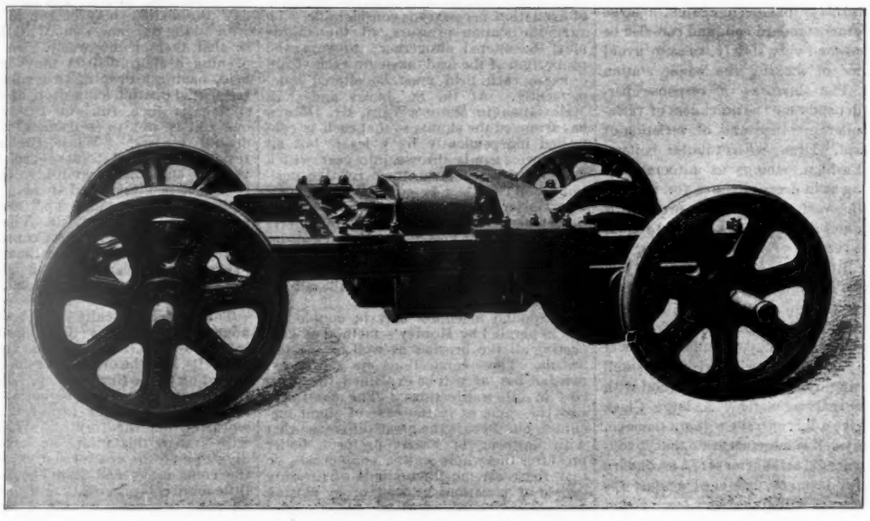
Mr. Charles E. Chapin entered the electrical field as secretary of the Waterhouse Electric and Manufacturing Company, of Hartford, Conn. On the sale of that company to the Westinghouse Electric Company, and the removal of the works to Pittsburgh, Mr. Chapin was transferred to New York and became the purchasing agent of the Sawyer-Man Electric Company. The rapid growth of the business of that company, both in the supplies furnished to central stations and the innumerable wants of a large factory, has required activity in the purchasing department, and Mr. Chapin has proved himself to be a successful buyer.

Messrs. Alexander, Barney and Chapin will occupy the same positions in the new firm as they filled in the Sawyer-Man Company, and start with a large experience in their respective departments. The new store will be ready about October 1st, and the firm will represent manufacturers in goods adapted to the electrical trade, as well as keeping in stock a line of general electrical supplies. In representing inventors and manufacturers, the new firm, from their wide experience, are particularly able to place the goods in the channels of the large trade of the country. The new insulating material, "Alexite," which is now receiving great attention, will be under their control.

We wish these gentlemen continued and growing success in their new venture and feel already assured that such a combination will result in nothing but good for the great electrical industry.

The McDougall Motor.

Mr. W. M. McDougall, engineer of the McDougall Electric Company, of this city, has recently patented the motor and method of suspension shown in our illustration. The motor is of the single magnetic circuit type, the pole pieces, field cores and yoke being mitis iron castings. The armature is formed of laminated sheet iron. The method of suspension, a Y bridge formed of two I beams of iron, is such that the motor may be applied to an ordinary street car truck, no special form of truck being necessary. One 20 horse power motor is used to each car, instead of two of less power. Power is transmitted from the armature to one axle through a double spur gear, the other axle running free.



THE MCDOUGAL MOTOR ON TRUCK.

Each gear is composed of a steel pinion and cast iron spur, both running in oil, in a closed iron case. This prevents the entrance of dirt which is so destructive to the life of gearing and also the noise which is common to many electric cars.

The suspending bridge is attached to the free axle by a universal joint of novel construction, which allows perfect freedom of motion in all directions. All bearings are self-lubricating. The weight of the equipment as shown in our illustration is about 2,360 pounds.

A new Stephenson car is equipped with the McDougall motor as above described, and is running on Seventh avenue, between Fifty-first street and Central Park. A representative of the ELECTRICAL REVIEW recently took a trip on this car, which is fitted up with storage batteries. There were 144 secondary cells in the car, with 24 cells cut out, leaving 120 in circuit. The car took the grade on Seventh avenue up to Fifty-fourth street with the greatest ease, running at about ten miles per hour. At this point the traction is 36 pounds to the ton. Mr. McDougall, who operated the car, reversed the motor while the car was in motion without using the brake. The car stopped and started back in a space of less than ten feet.

As yet the McDougall motor has only been applied to storage battery cars, but it is the intention of the inventor to adapt it to the overhead system as well.

Electric Lights in Spanish America.

The element of progress which has made itself manifest in the West Indies recently, a subject which not long ago was made the occasion of an oration by United States Representative Douglas, is especially notable in Havana, Cuba. As an incontestable proof of this fact, it is only necessary to cite the growth of the electric light industry in the island of Cuba.

About two years ago, a number of prominent capitalists of Havana organized the Spanish-American Light and Power Company, with the intention of establishing a small electric light plant for their own immediate use. A representative of this company was sent to the United States to examine the different systems of electric lighting. Decision was made in favor of the Westinghouse alternating current system. An apparatus consisting of two 750 alternate current dynamos was at once installed at the company's central station in Havana, and the operation of the plant was hurried as quickly as possible. But even before all the wiring had been completed, the Havanese became convinced of the great boon afforded them by a general introduction of the novel system of illumination. The result was that the company received a telegraphic communication asking it whether it was possible to ship at once by express alternating current apparatus, exciters, switches, etc., for a capacity of 3,000 incandescent lights. The Westinghouse people at once replied and the following day the entire plant, an express package of many thousand pounds, was shipped to Havana and immediately upon its arrival the plant was put up, giving the company a lighting capacity of 4,500 incandescent lights. Since then the company has been doing a very profitable business and electric lighting has constantly increased in popularity. The demand has steadily grown until it has now become larger than the company is able to supply and again enlargements have to be made.

The Westinghouse Electric and Manufacturing Company is now preparing for early shipment an increase to the plant of alternating current apparatus for 1,500 lights. This will give the central station in Havana a capacity of 6,000 lights.

The Street Railway Association of New York.

The eighth annual meeting of the above Association will be held at the Powers Hotel, in the city of Rochester, on the third Tuesday in September, 1890.

This meeting, which will be the sixteenth, will be especially devoted to electricity. A report on the subject of "An Electric Street Railway Motor" will be presented by Mr. John W. McNamara, president of the Albany Railway. The subject of the electrical propulsion of street cars being of so much concern at the present time to the street railway and municipal communities of this State, it was decided by the executive committee to invite the representatives of the overhead electric systems to the meeting to present the merits of their several systems of propelling cars by electric motive power. They will thus aid us in setting forth, as forcibly as possible, the success of electricity as a motive power, to the end that those companies which have had the change from horse-power to electricity under consideration, may be thereby greatly facilitated in accomplishing the change.

The Rochester Railway Company, through Mr. J. N. Beckley, vice president, have invited the gentlemen in attendance to take luncheon at one of the local clubs, and also dinner at Ontario Beach in the early evening.

The railway company hope to see a large gathering of New York State street railway men, and promise to do all in their power to make the visit pleasant. It is quite likely that there will be a Wednesday morning session, considering the amount to be accomplished in connection with the entertainment.

Westinghouse Strike Ended.

On September 3d, the strike of the Pittsburgh employés of the Westinghouse interests was ended by 1,200 men requesting to be reinstated in their old places at the old terms. This decision was the result of a meeting held by the strikers, who came to the wise conclusion that, as they could not hold out any longer, they had better resume work.

Gas and Electric Light.

The expectation that the spread of electric lighting would seriously diminish the consumption of gas is not being realized. On the contrary, the use of gas is steadily increasing, even where electricity is gaining the most popularity. Output figures from 40 different points for the first five months of the year, show an average increase in the consumption of gas over that for the first five months of 1889, of 13.2 per cent., and it is expected that the gain for the year will be even larger, owing to the increase in the use of gas stoves. This tells most, of course, in the Summer months.

Instead of electricity driving out the gas companies, the gas companies are absorbing the electric concerns. Indeed, that is the most notable feature of the gas industry this year. Nor, on consideration, does this seem strange, for the gas people are old hands at the lighting business, trained to serve the public with illumination. It matters much less to them how they shall give light than that they shall be the ones to give it. They were wise enough to abandon quickly what notion they may have had of depreciating electricity, and to decide to embrace rather than combat. Among the companies recently announced as having added electric lighting, or being about to add it, are those of Charleston, W. Va.; Wakefield, Mass.; Ventura, Cal.; Natick, Mass., and Belleville, Ill. These names will suffice to show that the small places are thus getting the benefits of a double system of lighting that could hardly be conducted with profit if divided between two corporations, with two sets of salaried officials, two independent plants, and two lots of stock to pay dividends on. In the large cities the tendency is for the heavy stockholders in the gas companies to become purchasers of electric light stock, or to become prime movers in the organization of new electric light companies. Thus at Louisville, Ky., a few weeks ago, five of the seven directors elected by the Louisville Electric Light Company proved to be directors of the Louisville Gas Company, who have been buying up electric stock. The gas company will guarantee the bonds of the electric light company. It was then thought that it would be only a matter of time when the gas company would get control of the Brush Electric Light Company also. A week later it was reported that a controlling interest in the Edison Illuminating Company's proposed plant at Milwaukee was owned by the Milwaukee Gas Light Company, or by certain of its shareholders.

It is in this connection that the most notable affair in the gas legislation of the year has taken place. The Massachusetts legislature passed an act allowing gas and electric companies to consolidate, which Governor Brackett promptly vetoed in response to the urgent demand of press and people. But the idea should not get abroad that in Massachusetts gas companies cannot legally engage in electric lighting. On the contrary, they have for three years had the right to buy or lease electric property or franchises in their territory when authorized to engage in electric lighting by the Board of Gas and Electric Light Commissioners. The bill vetoed would have allowed indefinite consolidation of companies with stock-jobbing possibilities that would have delighted the manipulators. Governor Brackett thought consolidations should not be left to the will of the corporations themselves, but should be subject to the control of the commissioners.—*Bradstreet's.*

ELECTRIC LIGHT NEWS

—— Oakland, Cal., will spend about $46,000 for street lights this year.

—— Spencer, Ind., has adopted the Schuyler system of arc lighting, and the company is now installing a 50-light apparatus.

—— It is stated, and we think correctly, that the first city to be lighted by electricity was Cleveland, O., the second, New Orleans, La.

—— The Schuyler Electric Company have received the contract for furnishing a 200 arc light plant for the city of Monroe, Mich., and are now at work on the installation of the same.

—— A new central station plant of the Westinghouse alternate current incandescent system is now being installed in the town of Milford, New Hampshire. Five hundred lights is the initial capacity of this plant.

—— By a new contract the city of Lowell will pay 40 cents instead of 50 cents per night for electric lights of 2,000 candle-power. The hours are from one-half hour after sunset to half an hour before sunrise.

—— The city of Marquette, Michigan, is increasing the capacity of its central station plant of electric lighting. The Westinghouse Electric and Manufacturing Company has been awarded the contract for alternating current apparatus for 1,500 lights.

—— The wilds of Virginia are soon to be penetrated by the brilliancy of electric lighting. In Buchanan, the Westinghouse Electric and Manufacturing Company has secured the contract for the installation of an alternating current electric lighting plant of 500 incandescent and 60 arc lights.

—— The Edison Electric Illuminating Company, of New York, announces that the rapid advance in its business and its increased facilities will enable it to reduce the rate for current, from October 1, to one cent per hour for each 16 candle-power lamp, or proportionate charges for lamps of greater power or for motor service. No further rebate for cash will be made.

—— The Consolidated Newark, N. J., and Schuyler Electric Light Companies awarded contracts last week for a new central station. The new building will be situated near the city dock on the Passaic River, on a plot 250 feet square. The companies paid for the ground $70,000. The building, engines, boilers, etc., will cost $80,000 more, making the total cost of the plant $150,000. The station will have a capacity for supplying with electricity 1,200 incandescent lights.

—— A prominent New Orleans oculist recently stated that, in his opinion, the incandescent electric lights were far better for the sight than gas or lamps. If correctly placed, that is, behind the eyes, throwing the light upon the page in front, they give a steady and comfortable light. They should be so arranged that in turning the head from side to side the eyes should not be presented immediately to the light. The arc lights in use on public streets have the same effect upon the eyes as is caused by looking squarely at the sun, causing a peculiar disease of the retina.

A One Hundred Dollar Prize Awarded.

Some time ago the city council of Davenport, Iowa, offered a prize of $100 for the best plan of lighting the city. The announcement of the award has just been made, and Mr. Fred H. Whipple, general manager of the St. Louis Electrical Exposition, has carried off the prize. The plant will be a first-class one in every respect and Mr. Whipple is to be congratulated.

We believe this is the first instance of the kind occurring in electric lighting circles.

ELECTRIC CLUBS.

THE NEW YORK CLUB TO GIVE A DINNER, OCTOBER 2D, TO INAUGURATE THE FALL AND WINTER MEETINGS.—OTHER CLUB NOTES.

New York Electric Club.

The Following Notice, under date of September 2d, has been sent to each member of this Club, and the answers already received would indicate that the attendance will be large :

DEAR SIR : At the suggestion of a number of the members, it is proposed to inaugurate the Fall and Winter meetings of the Electric Club with a dinner, to be given under the direction of the House and Entertainment Committees, at the Club House, 17 East 22d street, on Thursday evening, October 2d, at 7 o'clock.

The dinner will be given provided 80 seats are engaged on or before Thursday, September 25th.

Each member accepting will be allowed the privilege of one invited guest.

The charge for the dinner, including wines, will be $5 per plate.

The meeting will be social, enlivened with speeches, declamations, music, etc.

Please advise the secretary promptly upon receipt of this, whether you desire to be present and whom you will bring as your guest, in order that provision may be made for your comfort.

A large attendance and a most enjoyable time is expected. Don t miss it.

Yours sincerely,

OSCAR E. MADDEN, *President.*
CHAS. W. PRICE, *Secretary.*

The Club Dinner to be given on October 2d promises to be a brilliant affair. A large number of places have been engaged, and at the present rate some fellow is going to get left, as the Club accommodations are limited.

Tom Doolittle, that old telephone man, has a new excuse—"snapped the hitching line." About 10.45 one night last week, a young man picked up a team on a road near Bridgeport, the home of the Doolittles. He turned the team over to a man near by. About 12.40 G. Q., T. B. D. came into the police station and said some fellow had stolen his team. He was given a description of the find reported by the young man, and it answered his. He procured another rig and drove off to get his own. He found it, and said the horse had become restless "and snapped the hitching line."

Philadelphia Electro-Therapeutic Society.

A Number of physicians and surgeons of Philadelphia, have formed themselves into an organization called the Electro-Therapeutic Society. Dr. George B. Massey is president, and Dr. William H. Walling secretary. The object of the society is to discuss the question of electricity combined with medicine and surgery. Heretofore the subject has been empirical, and it is proposed to take it out of the hands of the irregulars, so that the regularly certified practitioners can make it popular from a scientific standpoint.

The Glen Echo Electric Railway.

The North American Construction Company, of Pittsburgh, have commenced the construction of the electrical portion of the Glen Echo Railroad. Westinghouse apparatus will be used entirely. The power station will have two Babcock & Wilcox boilers, 100 horse-power each, with mechanical stokers, two Westinghouse compound engines, 100 horse-power each, and two Westinghouse dynamos, 80 horse-power each. Six Brill cars, with two 15 horse-power motors each, will be operated by the single trolley system, 500 volt current. The road will be in operation about the first of November. It is three miles long and extends from the Northern terminus of the Washington and Tennallytown road to the Potomac river. The Glen Echo Railroad Company is organized in Maryland, with a capital of $100,000, in $50 shares. Its officers are : Edwin Baltzley, president; F. W. Pratt, vice-president; J. C. Pratt, treasurer and Edward Baltzley, secretary. The office of the company is in the Sun building, Washington, D. C.

The Coupling and Control of Dynamos in Central Stations.

BY JAMES SWINBURNE, IN LONDON "INDUSTRIES."

The last arrangement discussed was an electric governor, which either controlled the steam supply of all engines simultaneously, or controlled the throttle valves or cut-offs of all of them at the same time ; the proportion of steam taken by each being regulated independently by hand once for all on starting each engine. This seems the most satisfactory way of governing the engines electrically. The main electrical governor can be made very accurate by means of relays balanced against a large Clark or other standard cell, and can also be made to respond very slowly, so as to avoid any chance of making the whole station "hunt." The slowness of response permissable depends on the quickness of variation of boiler pressure and of variation of station load. Even with tubular boilers, such as Fashion, who is as autocratic in engineering as in dress, dictates for modern stations, the variation of steam pressure is not rapid, and the load on a central station also varies very slowly. High-speed engines with very little inertia are also in vogue just now, so it is easy to make a general station governor free from any danger of hunting. Many people would regard a Clark cell as unable to control a relay of sufficient power to be safe ; but these cells are made small for balancing by Poggendorff's method with a sensitive galvanometer. A large Clark cell will give a fair current without damage. Almost any cell is more accurate than a voltmeter or solenoid arrangement. A secondary battery, for instance, balanced against the station pressure will give a very large power with a small variation of pressure.

As the governor may sometimes go wrong and raise the E. M. F. throughout the station, thus breaking some thousands of lamps, it would be risky to give it complete control of a station and to rely upon it absolutely. Controlling by hand is expensive, and is apt to be intermittent or occasional. It would, therefore, be infinitely better to combine the advantages of both systems by allowing the governor complete control within a margin of, say, one per cent., and relying on a thinking being for large adjustments. When the governor reaches the end of its tether an attendant turns the whole station a half per cent. up or down, as the case may be. This must be done very slowly, so that the governor can have time to counteract it, thus keeping the pressure really constant. The governor is thus left at the middle of its range again. The control of an incandescent lamp station within $\frac{1}{10}$ per cent. or so is of enormous importance in connection with efficiency and lamp renewals.

Instead of electrically governing the engines, the ordinary speed motors may be used, and the dynamos may be controlled by varying their excitation. The engines do not then really need to run at constant speed ; all that is necessary is that for every speed there shall be a determinate steam supply, or, if the boiler pressure varies, that the speed will be constant within the limits of safety of the engine. Regulation by excitation then really becomes a roundabout method of controlling the steam supply, and nothing more. For if a machine is giving 100 volts and 1,000 amperes, the station pressure being 100 volts, and it is required that that machine shall only give 500 amperes and 100 volts, the field is weakened. If the engine had the same cut-off, so that its torque was constant, the speed would increase until the torque was as before. But as the field is weaker, this torque can only be obtained by delivering a current greater than 1,000 amperes. An engine giving constant torque driving a dynamo on constant pressure is thus in an unstable equilibrium. Suppose, however, that the cut-off or throttle valve is controlled by a speed governor, on weakening the field the engine increases its speed till the governor cuts the steam down, and by weakening the field enough, the engine runs up till the steam supplied only gives a torque, which, with that field, corresponds to 500 amperes. The regulation of the field is thus merely a method of turning on or off the steam, and nothing more. Of course, these remarks only apply completely to central stations under the conditions discussed. The regulation of the field of a dynamo driven from a shaft, which also drives, say, a machine shop, is not the same ; as the speed of the shaft, and, therefore, the governor and steam supply, do not wholly or even mainly depend on the torque in the dynamo.

In a station with each engine governed for speed, it is perhaps best to arrange the governor so as to admit a fair variation of speed between no load and full load, as such governors are more easy to make, and in this case will do as well, or perhaps better, than if they were nearly isochronous.

As the load on a station increases, the engines will need more steam, and to get this they must run slower. The fields must, therefore, be strengthened. In the case of shunt machines, which have a falling characteristic, as must especially be the case in large single magnet dynamos, the variation of excitation necessary is considerable. To vary the station pressure, all the shunts must be altered altogether; to vary the proportion of the load taken by each steam dynamo, each field must be altered independently. At the St. James and Pall Mall station, in Mason's Yard, Mr. Dobson has arranged the shunts so that each is controlled independently by a lever, but all these levers can be thrown into gear with a master lever, whatever their relative positions, and can then be controlled together. The master lever controls the pressure of the whole station, and the individual levers the proportion of load taken by each steam dynamo. If an electric pressure governor were used it would control the master lever.

When shunt machines are used the margin for control must be great.

Compound machines may be coupled to run in parallel by Mordey's method of connecting all the brushes as well as the terminals. These connections are a little expensive, but, as will be explained, they save cost in other directions. The control is just the same as in the case of shunt machines, but there is the great difference that with uniform, or nearly uniform, boiler pressure, the whole station compounds, so that there are no fluctuations of pressure caused by variations of load, or by putting in machines or cutting them out. In large machines, with great back induction, this means a great saving of resistance and regulating appliances. As a rule, station dynamos are only at light loads at the instant of coupling in, the working range being from half to full load. If they are to be coupled in at full speed, the resistances for controlling a shunt machine must be enough to cause the whole variation of field. Generally, a shunt machine is put into circuit at a lower speed with full field ; but in any case it is advisable to have resistance enough to go through the whole range of the dynamo. This means a very large resistance board, and a very large drain of electrical power going to waste. Ten dynamos of 100,000 watts each may thus waste two or three horse-power among them on adjustable resistances. With compound machines nearly the whole of this waste can be saved. There seems, therefore, to be a heavy balance in favor of compound machines for station work.

Parallel coupled stations without batteries give most trouble when feeders are used. Feeders may be worked in several ways. The station pressure may be kept uniformly high—say, two per cent.—and the feeders may be thrown in as the load increases in such a way that there is always two per cent. drop in them. It is not necessary that the drop should be the same in the feeders to all districts. One district, close to the station, may be always run at, say, 102 volts without feeders ; the next district, a little more distant, may have nothing but 101-volt lamps ; and a still more distant district may be supplied with 100-volt lamps. The service mains of these separate districts must obviously not be connected directly in a network, but they may be connected by feeders which have enough resistance to have the requisite drop when they alone supply the outlying districts during the times of lightest loads. The station pressure is then kept at 102 volts always. It may be preferable to make the whole station "compound up" a little—that is to say, give a higher pressure when the load is heavy. When feeders are not used this improves a direct supply. For instance, when the mains are arranged concentrically round the station with radial feeders, as the Pall Mall station already mentioned, if the lamps are all 100 volts, the station may give 100 volts at light loads, so that all the lamps then have 100, the drop being negligable ; at full load the station runs up to 101 volts, and the near lamps get 101, the medium 100, and the distant 99 volts, giving a maximum variation of only one per cent. This principle is equally applicable in the case of feeders, and lessens the cost and complication of the systems. The case of concentric service mains supplied by radial feeders is a particular case of districts fed by connecting feeders with no network of mains connecting the districts. In the case of a larger area, additional feeders can be run direct to the outlying districts. If the districts are all provided with lamps for the same pressure, and if the station is run in parallel, there must always be considerable waste of power in the feeders, unless the compounding up half-way method is adopted ; for the distant lamps must have full pressure, so the whole station must be run with the additional pressure lost in the feeders. In some cases the feeders are not thrown in and out, but have resistances inserted in them. The Edison Station at Boston, for instance, is run this way. A certain percentage of the power of the station is then always allowed to run to waste either in resistances or in feeders. A great deal of this loss can be saved, however. Instead of arranging the feeders and resistances so as to have a constant drop in them the whole of the day, they may be regulated so that, at any given time, the drop in all the feeders is the same, though at different times the drop differs. For instance, in the day the station may be run at 100 volts, with all the resistances out of all the feeders, so that there is no waste. In the early evening a shop district may be at full load, having a drop of two volts, while a residential district has a drop of one. The station is then run at 102 volts, and one volt is lost in resistance in the residential feeders. When the shop and residential district feeders each lose one volt, the station runs at 101 volts, with no resistance in either, and so on. The principle of "compounding up" may also be applied here to some extent. The saving is very large compared with a constant drain, which is probably under-estimated at two per cent. Two per cent. in a 50,000 lamp station means the waste of power equal to 1,000 lamps !

The feeder difficulty may be more economically treated by dividing the station into two parts. One is run at from 100 to 101 volts, and the other at from 100 to 102, according to the time of day. The distant feeders are connected to the latter part of the station, and the nearer districts are worked from the former. With a three-wire system this means no less than four divisions of the central station plant ; but the connections and switchboards are but little more complicated than if the machines all run in parallel on direct supply. Of course, battery systems admit of feeder regulation in the greatest perfection ; but the advocates of batteries are a little apt to overlook the extra cost of the switches and connection gear, and the troubles involved in uneven discharge of some of the cells.

The Rae Electric Railway System in Kansas City.

The Detroit car (Rae system) that has been in operation on the Vine street line in this city, says a Kansas City, Mo., exchange, for the past few weeks, has been pronounced a success by all who have ridden on it, and the management of the road are entirely pleased with the new device, though whether more will be ordered is not known, as the property has recently changed hands.

The most noticeable and agreeable feature of the car is its freedom from noise while in operation, and this characteristic is observed by everybody who has given the matter the least attention. No more noise is observable than in the running of an ordinary car, which contains no machinery at all. The leatheroid and steel gearing seem to have accomplished the ends that they were designed for, and the reduction of the amount of gearing that is required to operate the car, as compared with other systems, has tended toward this desirable end as well as many others, such as simplicity and cheapness.

Those who are interested in such matters have expressed considerable satisfaction in the arrangement of the machinery under the car. The single motor of 30 horse-power, with its armature shaft running lengthwise of the car, geared into the countershaft, which, in its turn, communicates the motion to the axles by means of bevel gearing at its ends, presents features that Kansas City engineers believe to be valuable, and to show progress in the right direction. The load being evenly distributed on both axles, as it cannot be when two motors are used, the danger of stripping the gearing is lessened, and the usual working strains are equalized.

Motor men seem to be as well pleased with the car as the management is, and the reduction in the amount of motion of the controlling apparatus on the platform has met with considerable favor.

Among the recent installations made by the Schuyler Electric Company in Southern cities are : 80-light plant at Spartanburg, S. C.; 30-light plant at Blacksburg, S. C.; 50-light plant at Bedford City, Va.; 50-light plant at Buena Vista, Va., together with a 500-light alternator. The company reports business very brisk in all lines, the factory being overcrowded with work.

OUR LONDON LETTER.

The City and South London Railway Company.—The shareholders in this company met at Winchester House on the 12th inst. to receive the directors' report. Up to the present time the company had only spent some £660,000, which was very close to the original estimate. The meeting unanimously accepted the report, and appeared much pleased with the progress of the work.

The Kensington and Knightesbridge Electric Light Stations.—The two stations of the company are now completed in all details, and a week ago Mr. Crompton invited the residents of the district to an inspection. There is further space, and it is intended to erect other machines, but at the present time there are four dynamos of 200 horse-power and three of 90 horse-power, and the batteries of the immense storage cells are capable, in case of need, of giving a current of 1,200 amperes at 110 volts. The engines are of the Willans type, and are provided with flywheels for steadier drawing of the dynamos, which are coupled direct. The steam power is developed by three sets of boilers, 250 horse-power capacity, constructed by the Babcock & Wilcox Company. The building is in red brick, and has a splendid appearance; everything is thoroughly clean and perfectly arranged, and it is to be hoped that the public will so sufficiently patronize as to *recoup* the company for the necessarily first heavy outlay.

Electric Lighting of Churches, South Kensington.—The arrangements for the lighting of the Church of St. Jude, South Kensington, have now been completed between the vicar and church wardens and the House to House Electric Supply Company, of Richmond Road, West Brompton. There are to be 275 incandescent lamps of eight candle-power, the present gas fixtures being utilized where possible for the distribution of the light. In the nave there are to be 144 lamps, and 12 in each of the 12 coronas. In the chancel there are to be 66 lamps, and 28 for the lighting of the aisles. The installation will be completed, connections made with the company's mains and the current supplied, within about a month.

Fulham.—The vestry has resolved to prevent any of the electric light companies obtaining powers to supply current through the district, and have also refused Mr. S. Morse's application on behalf of the Chelsea Electricity Supply Company, Limited, for permission to obtain a provisional order authorizing the running of electrical trams along the Fulham road and the King's road through the parish.

Hammersmith.—In Hammersmith also the vestry are hostile to the employment of electricity on the tramway, notwithstanding the strongly expressed desires on the subject of the neighboring parishes of Chiswick and Brentford. The *Star* expresses a very plain opinion that the matter is arranged by fees to the vestrymen.

New Electric Miner's Lamp.—I hear from Paris that M. Constant Rousseau has at last solved the difficulty of a portable electric mining lamp. The lamp contains a Plante accumulator arranged on M. Pollack's plan, is about the same size as the ordinary miner's lamp, forms an upright square and is divided diagonally into four cells. The small incandescent lamp carried is protected by a second glass bulb. The duration of lighting is 11 hours and the weight about 4½ pounds. Present cost about 30 francs, but if made in quantities there would, of course, be a considerable reduction. The Societé de l'Industrie Minérale gives a very favorable report upon specimen lamp submitted to them.

Messrs. Woodhouse & Rawson United. Limited.—This company have now taken West End offices at 16 Great George Street, Westminster, and which will be under the management of Mr. H. Sampson King. They have also informed me that the business of the firm of Messrs. King, Westerman & Terry, iron and steel founders and boiler makers, of the Union Foundry, Kidsgrove, Staff., has been taken over. These old established works are situated in the heart of the Staffordshire coal and iron district, and have direct railway and canal communication with all parts of the kingdom. The company's annual excursion was held a few days since and I hear a most enjoyable day was spent at Brighton.

The Maxim-Weston Company.—This old company is now doomed. At a special meeting, held a few days since, at Winchester House, the following resolution was, after considerable discussion, adopted: "That it has been proved, to the satisfaction of the meeting, that the company cannot, by reason of its liabilities, continue its business, and that it is advisable to wind up the same; and, accordingly, that the company be wound up voluntarily." Mr. Marks and Mr. Hodgson were appointed liquidators. It is stated that there is sufficient money to pay all liabilities.

The Victoria Torpedo.—The *Times* gives particulars of a new torpedo, invented by Mr. Murphy, of Melbourne, and manufactured by Messrs. Heenan and Froude. It has a range of two and a half miles, is 24 feet in length, is driven by a screw propeller worked by compressed air. The steering and control are effected by electricity, by means of three lines, of several strands each, forming a cable weighing one and a half ounces to the yard. The torpedo carries 1,200 yards coiled upon a free coil in an oil chamber. When the torpedo is started, the cable is given out from shore, but after attainment of a certain speed for every yard given out from shore, nine yards are uncoiled from the torpedo. Three motors are carried, weighing two pounds seven ounces each, and control the rudders, starting gear and the exploding arrangement, each electrical impulse giving a definite effect.

The Edison Phonographic Toy and Automaton Company, Limited.—All applicants for shares in this company have received a notice from the secretary that, owing to questions having arisen as to the ownership of certain of the patent rights, no allotment of shares should be made, and that all money paid on application for shares will be returned.

Edinburgh Exhibition Awards.—The executive council of the exhibition have decided that there shall be no awards in the electrical section.

The Liverpool Overhead Railway Company.—The company's fourth half-yearly meeting was held the other day in Liverpool. The directors' report stated that the progress of the construction had not been as great as was looked for, owing to technical difficulties, but these had been surmounted, and the work would go forward now with greater rapidity. The chairman said they were now turning out two spans per day, and if it continued at this rate the line would be complete in about 12 months. The propelling power adopted was electricity. From everything he could see they would have a large traffic, and he looked to the future with great expectation.

The Southend Electric Railway.—Messrs. Crompton & Company have now completed the electric tramcar on the pier at Southend. The engine, boiler and dynamo are situated under the arches at entrance of pier, and the current is carried along the central rail for three-quarters of a mile down the pier. The car holds about 40 persons, and travels about 16 miles an hour, doing in three and one-half minutes what the ordinary horse traffic takes a quarter of an hour for. Dr. Hopkinson certified the line, and on the Saturday preceding, bank holiday, it was handed over to the local board for public use. The holiday folk greatly patronized it, and there is little doubt it will be a very paying concern. Last Friday, Messrs. Crompton lighted the pier by electricity, having provided seven arc lamps for the pier and the new pavilion.

Lyons National and Colonial Exhibition, 1892.—It has been decided to hold a great national and colonial exhibition at Lyons, in France, in 1892. Two sections will be international, silk and electricity.

Dusseldorf.—From the *Kælnische Zeitung*, I learn that the corporation of Dusseldorf, on the Rhine, have resolved to erect a central electric lighting station for about 20,000 incandescent lamps, at the amount of two millions of marks, with direct current and accumulators. After a paper read by the consulting electrician, Professor Kittler, of Darmstadt, the installation was placed in the hands of Messrs. Schuckert & Company, of Nuremberg.

The Gaulard Memorial.—The tablet to M. Gaulard by the Societa Elettricita Italiano, of Milan, was recently uncovered at Lanzo, Italy.

Personal.—Mr. H. M. Byllesby, the popular managing director of the Westinghouse Company, of 4 Victoria Mansions, Victoria street, Westminster, who has been arranging the affairs of the company in this country, and has brought them into a most prosperous condition, returned to New York on the 20th inst. He has made many friends on this side and will be greatly missed.

West Africa.—The first electric light installation in West Africa was started at the end of May last, at the Gie Apponto gold mine on the Gold Coast. A Siemens compound dynamo supplies 15 lights to the stamp mill house, engines and boilers. The installation was carried out by Mr. J. A. R. Milton, formerly with Messrs. Woodhouse & Rawson.

CHARLES FFRENCH.

London, Aug. 21st, 1890.

Anti-Magnetic Watches.

The Central Electric Company, of Chicago, is exhibiting a handsome line of Anti-Magnetic Watches, and has completed arrangements with the Electricians' Time Company for handling the same. These watches range in price from $10 up, and as each one is accompanied by a guarantee from a responsible firm, and the method of payment made easy for the purchaser who cannot afford to pay for the watch in cash, they will, no doubt, meet with popular favor among electrical men.

The Hedgehog Transformer.

Last year Mr. Swinburne brought forth the theory that an open iron circuit could be made more efficient than any form of closed iron circuit transformer. The loss in a transformer is made up of loss in copper due to resistance, and loss in iron due to hysteresis. In calculating the efficiencies of transformers, the loss in the iron has generally been left completely out of account, and the loss in copper alone considered. Hence the efficiencies of 97 and 98 per cent. claimed for closed iron circuit forms. If the loss by hysteresis is taken into account, allowing the losses as given by Ewing, the

FIG. 1.—HEDGEHOG TRANSFORMER.

loss in iron in closed circuit transformers, as usually designed, is some 10 per cent. of the full load. As the loss in iron goes on all the time a transformer is in circuit, this is very serious. The proportion of actual to possible output of energy per day varies in different districts, but in most stations the average use of lamps is less than two hours a day, including all the lamps installed. The transformer must be large enough to feed all the lamps installed, so it runs, say, an average two hours of full load a day. If there is a loss of 10 per cent. of full load in the iron, this gives an actual efficiency of 45.5 per cent. even neglecting the loss in copper. In the Hedgehog form the proportion of iron is very much reduced. The cross section of the iron is much less, and the length is about one-third of the closed circuit form, as it has not to surround the wire. The result is that even in small transformers the iron loss is under one per cent. of the full load. One per cent. of the full load gives 89 per cent. all day, neglecting copper loss, against the 45 per cent. of

FIG. 2.—SAME, STONE JAR REMOVED.

the closed circuit. This is neglecting copper, however, and the copper loss is greater in the Hedgehog form, so this is an exaggerated comparison. Such a transformer really has an efficiency of about 80 per cent. all day.

The theory of the Hedgehog form is this: If a closed iron circuit is used, the iron circuit must be long, to embrace the copper coils. The only way to shorten it is to make the copper coils smaller. This means using a higher current density which is wasteful, or fewer turns of copper. Fewer turns of copper demands either a higher induction in the iron, or a greater cross section, and both of these means greater loss by hysteresis. If the iron circuit is open, the sides of the embracing core can be removed, so the loss by hysteresis is divided by three. As there is now plenty of room for copper, the turns and cross section can be increased and the iron reduced still further. The object of introducing the closed iron circuit was to reduce the magnetic resistance. An open circuit transformer has much higher magnetic resistance. The question of magnetic resistance is not so important as might at first sight appear. Its increase demands more excitation, or more magneto motive force, and this increases the loss in copper. The best form is thus a compromise. The Hedgehog ends are to reduce the magnetic resistance. In a conductive circuit the resistance is high. Similarly in a composite magnetic circuit of iron and air, the magnetic resistance is low if there is never a high magnetic current density or induction in the air, which has high specific magnetic resistance.

The magnetizing current in a Hedgehog is high, but as it is a quarter of a period behind the primary current in phase, and as the primary wire has to be large enough to carry the primary current, the loss in watts is small. As this loss goes on all day, however, it is by no means unimportant, and has to be included in getting out the efficiencies of these transformers. The construction of these transformers, as carried out by Messrs. Swinburne & Company, of Teddington, England, is very simple. A gun-metal casting of cross shaped section forms the backbone. It is spread out at each end, forming legs at one and taking the circular terminal board at the other. It also carries insulation flanges which form the ends of the coils. Into the four recesses of the core are put four handles of soft iron wire. These are taped over and the secondary is wound on. The secondary is then covered with two layers of ebonite, and the flanges are also faced with the same material. The primary is wound on in two compartments separated by ebonite, after the manner invented by Gramme, so that both ends come outside, and as far removed from each other as possible. The ends of the core are then spread out and the transformer tested under 4,000 or 5,000 volts, the insulation in megohms being read by a peculiar instrument which measures the effective resistance under an alternating current.

As iron cases cannot be used, as they would be magnetized by the transformer, and as any metal would have Foucault currents generated in it, stone-ware jars are used for cases. These have lids bolted down, with holes for leads as shown.

New Business of the Short Electric Railway Company.

The Short Electric Railway Company has recently received an order from the White Line Street Railway Company, of Dayton, Ohio, for the equipment of motor cars, and shipments have already been made.

The same company is shipping car loads of motors to Rochester every few days, and will soon have the order for that city completed. The Rochester Railway Company expect to have a number of the cars of the Short system in operation in that city within the next 30 days.

The Short Company has also just shipped two more generators to St. Louis for further equipment of their road in that city.

The Muskegon Railway Company has ordered from the Short Electric Railway Company three more motor trucks, one to be equipped with 36-inch wheels for a high speed car.

Copper.

There is a strong tendency towards higher prices for the dividend copper stocks, and the small offerings show with what confidence actual holders of the shares view the present and future demand of the metal. New York metal brokers are evidently endeavoring to under-rate the situation. It is given out that the Calumet is willing to book orders up to December at 17 cents, but we can state officially that the Calumet has not offered any copper at 17 cents beyond September delivery. In two sales which have been made, the actual delivery may not occur until October, possibly November, but interest is charged up to the account after September.

It is believed by some mining interests in Boston that Mr. Lewisohn has sold some copper at higher figures than rule now, and that in consequence he would like to see some large offerings of the metal by producers, but, as a matter of fact, supplies under 17 cents do not appear, and at that price are only offered in small quantities.

London—Copper, G. M. B., spot, £59 17*s.* 6*d.*@£60; futures, £60 2*s.* 6*d.*@£60 5*s.*—*Boston News Bureau.*

KINDRED INTERESTS

The Westinghouse Electric and Manufacturing Company is now occupied with the installation of an electric plant at Galveston, Texas.

The Electric Merchandise Company, Chicago, are out with a most complete catalogue of electrical supplies. Electric railway materials are their specialty.

The Goulds Manufacturing Company, Seneca Falls, N. Y., have issued another special catalogue describing their triplex pumps actuated by electric motors.

The Climax Tape manufacturers, the Boston Rubber Shoe Company, after being shut down for two weeks, as is their custom at this season of the year, have again resumed operations.

The Thomson-Houston Electric Company is about to erect a new factory at West Lynn, Mass., 190 by 80 feet, three stories high, for heavy machine work in connection with their large dynamos. The building is to be provided with a large traveling crane, equipped with three motors, for handling the heaviest products.

The Connecticut Motor Company, of Plantsville, Conn., having increased their capital stock, will extend their facilities for manufacturing motors and generators, which are well liked wherever they are used. The amount of business done during the month of August is reported to exceed any previous month in the current year.

The C., B. & Q. Ry. is remembered with pleasure by the electrical men who traveled over this road from Chicago to Kansas City last Spring. The officials are men accustomed to handling a crowd in the most artistic fashion and the road is all that could be desired. It is a good way for western people to get to the St. Louis Electrical Exposition. Mr. H. E. Heller, of this company, was at the Cape May Electric Light Convention renewing the pleasant acquaintances made at the Kansas City meeting.

Great Western Electric Supply Company.—The assortment of testing instruments shown by the Great Western Electric Supply Company is steadily growing. During the past week a nice lot of Wheatstone bridge sets mounted in compact cases were added. These have sensitive galvanometers with arrestment for the needles, and are carefully calibrated. Together with the detector galvanometers, portable magnetos and speed indicators in stock, and the voltmeters and ammeters now under way, form a collection of such apparatus as every station manager would feel proud of. It certainly pays well to know in just what shape the dynamos and circuits are, and the handling of such testing instruments as the above firm is showing will meet with approval from all who are interested in electric work.

The Interior Conduit Company.—The fire which partially destroyed the factory of the Interior Conduit and Insulation Company, on Tuesday night, August 26th, started in the drying rooms, and after burning many thousand feet of green or untreated underground tube, and effecting the destruction of the underground curing apparatus, was checked so that the output of underground conduits will only be temporarily restricted. The company having kept the original factory in West Twenty-seventh street on Interior conduit work, this branch of the business will not be interrupted, and with the aid of additional temporary factory facilities secured in that neighborhood, they will be enabled to aid the underground department materially. The burned building will be immediately rebuilt, and a new structure, seven stories high, will be added. This will more than double the present accommodations and enable them to keep pace with the extraordinary demand for their products.

The Central Electric Company has just received a large stock of the new Stoddard porcelain cut-outs. This device has come into great favor with electrical construction men, and the Central people report very large sales of the same. This company has placed in stock a number of Perry wire peelers, which was illustrated some months since. This handy little tool is just adapted to bell-hangers and incandescent wiring men's use. The company is very much flattered with the favor with which its new spark arrester is being received by the public. This device, as well as preventing sparks from falling from arc lamps, also prevents flies and other insects from getting into the globes.

FINANCIAL.

Closing quotations of electric stocks, from F. Z. Maguire, Electrical Securities, 18 Wall street, N. Y., Thursday, September 4, 1890. New York, Boston and Washington Stock Exchanges.

NEW YORK.

Western Union Telegraph Co	83⅝
Edison General Electric Co	104.
" " Preferred	
Consolidated Electric Light	60.
Edison Electric Illuminating Co	
United States Electric Light	35.

BOSTON.

Thomson-Houston Electric Co	49.
" " " Preferred	25¼
" " " Series C	12.
" " " Series D	5¾
" " International	
" " Welding Co	
" " European Welding Co	87.
Ft. Wayne Electric Co	119½

TELEPHONE:

American Bell	224.
Erie	49½
New England	52.
Mexican	.90.
Tropical American	

MISCELLANEOUS:

Edison Phonograph Doll	2.

WASHINGTON.

Pennsylvania Telephone	25.
Chesapeake and Potomac	72.
American Graphophone	17¼
United States Electric Light (Washington)	160.
Eckington and Soldiers' Home Railway	69.

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ELECTRICAL PATENTS

INDEX OF INVENTIONS FOR WHICH LETTERS PATENTS OF THE UNITED STATES WERE ISSUED ON AUGUST 26, 1890.

(*Continued from last Issue.*)

435,047 Incandescent lamp socket key. 435,048 435,049 Cut-out; Walter F. Smith, Philadelphia, Pa., assignor to the United Electric Improvement Co., Gloucester City, N. J.

435,084 Electric lighting system; Alexander H. Bauer, Chicago, Ill., assignor to the Pullman's Palace Car Co., same place.

435,093 Electric switch; Chas. H. Herrick, Winchester, Mass.

435,097 Electric signal for cable railways; Solomon J. Jacobs, New York, N. Y.

435,098 Automatic disconnector for overhead conductors; Andrew L. Johnston, Richmond, Va.

435,105 System for electric circuits; Frederick Stitzel, Louisville, Ky.

435,110 Electric forging machine. 435,111 Electric bar heating and feeding apparatus for forging machines; Geo. D. Burton, Boston, Mass.

435,114 Means for distributing electric energy; Sebastian Z. De Ferranti, London, England.

435,116 Guard for electric light globes; Robt. M. Gardiner, Hamilton, assignor of one-half to Wm. Hilborn, Ayr, Canada.

435,132 Electric switch; Joseph W. Battershall, Attleborough, Mass.

435,152 Electric switch; John A. Norton, Bridgeport, assignor to John C. English, New Haven, Conn.

435,166 Trolley or contact support for electric cars; Leonard Atwood, Philadelphia, Pa.

435,177 Spark arrester; Albert M. Harris, South Bend, Ind.

435,185 Electrical watchman's clock; Harvey S. Park, Chicago, Ill.

435,213 Electric alarm for clocks; William H. Deane, Brooklyn, N. Y., assignor to himself and J. J. Mahon, same place.

435,223 Electric cut-out; Chas. Heisler, St. Louis, Mo., assignor to the United Gas Improvement Co., Philadelphia, Pa.

435,248 Electric arc lamp; Erneste Rothlisberger, Lima, O., assignor of forty-nine one-hundredths to John W. Wagman and Geo. W. Buchanan, same place.

435,259 Electric device for preventing accidents on railways; Gilmore Lhew, Peru, N. Y.

435,261 Generator for electric engine circuits. 435,262 Structure for supporting and insulating suspended bare conductors. 435,263 Electric railway conduit with tubular conductor. 435,264 Reciprocating electric hammer; Chas. J. Van Depoele, Lynn, Mass.

435,283 Method of and apparatus for welding by electricity. 435,284 Process of heating metals by electricity; Chas. L. Coffin, Detroit, Mich.

435,292 Autographic telegraphy; Harry Etheridge, Pittsburgh, Pa., assignor to the Writing Telegraph Co., of New York, N. Y.

435,295 Automatic telephone connector; William H. Ford, St. Louis, Mo., assignor by direct and mesne assignments to the Automatic Electric Exchange Co., East St. Louis, Ill.

435,296 Contact brush for dynamos; Eugene Franklin, Greenville, S. C.

435,314 Telephone tablet; Walter S. Mendenhall, Covington, Ky., assignor to Eleanor Tatum (administratrix of Samuel A. Tatum, deceased), Cincinnati, O.

435,332 Automatic current regulator; Rene Thury, Geneva, Switzerland, assignor to Cuenod Sautter & Co., same place.

435,340 Automatic electric train signal and controlling device; William H. Wilson, New York, N. Y., assignor of one-half to William J. Kelly, Boston, and Chas. H. Arnold, Woburn, Mass.

435,343 Articulated electro magnet; Fred. H. Brown, Chicago, Ill.

435,346 Galvanic battery; Chas. J. Hubbell, New York, N. Y.

435,368 Extension electrolier; James F. Robb, Mount Vernon, assignor to the Edison General Electric Co., New York, N. Y.

435,376 Electro-magneto therapeutic chair; Frederick H. Brown, Chicago, Ill.

COMPLETE LIST ISSUED SEPTEMBER 3.

435,424 Electric switch; Chas. W. Huntington, Baltimore, Md.

435,438 Telephony; Thos. D. Lockwood, Melrose, Mass.

435,440 Automatic electric annunciator; John W. Luthe and Alfred E. Jeavous, Cleveland, Ohio, said Jeavous assignor of one-half to said Luthe.

435,447 Electric conductor for street railways; Luther M. Perkins, St. Louis, Mo.

435,471 Electric railway closed circuit system; Malone Wheless, Nashville, Tenn., assignor by direct and mesne assignments to the Wheless Electric Railway Co., Alexandria, Va.

435,482 Block and signal system; Mallon S. Conly, Chicago, Ill., assignor to the United States Electric Railway Signal Co., New York, N. Y.

435,486 Conduit for electric railways. 435,487 Electric conduit; Wm. R. Elliott, Kansas City, Mo.

435,490 Automatic electric switch; Theodore M. Foote, Boston, Mass.

435,503 Commutator. 435,504 Commutator and process of making the same. 435,505 Suspender or support for overhead wires; Chas. A. Lieb, New York, N. Y.

435,516 Electric signaling apparatus for preventing collisions between railway trains; Theodore Perls, Wurzburg, Germany, assignor of one-half to Martin Perls, London, England.

435,525 435,526 435,527 Regulator for dynamo electric machines; Chas. E. Scribner, Chicago, Ill., assignor to the Western Electric Co., same place.

435,536 Electric conduit; Herbert N. Curtis, New York, N. Y.

435,545 Automatic regulation of electric circuits; Geo. B. Prescott, Jr., Newark, N. J., assignor to the Accumulator Co., of New Jersey.

435,550 Electrical measuring instrument; Geo. N. Walker, New York, N. Y., assignor to the Walker Electric Co., same place.

435,559 Upward pressure contact for electric railways; John A. Duggan, Quincy, Mass., assignor to the Burnham & Duggan Railway Appliance Co.

435,578 Switch for incandescent lamp sockets; Waldo C. Bryant, Bridgeport, Conn.

435,629 Apparatus for covering electric wires; Alfred G. Holcombe, Long Island City, assignor of one-half to Chas. L. Browne, New York, N. Y.

435,639 Electric motor; Harry H. Blades, Detroit, Mich., assignor to the Detroit Motor Co., same place.

435,640 Means for supporting storage batteries on railway cars. 435,641 Electric railway car; Harry H. Blades, Detroit, Mich.

435,642 Electric railway car. 435,643 435,644 Method of electric welding; Mark W. Dewey, Syracuse, N. Y., assignor to the Dewey Corporation, same place.

535,660 Manufacture of filaments for incandescent lamps; Vincent M. Hobby, New York, N. Y.

435,662 Electric railway; Rudolph M. Hunter, Philadelphia, Pa., assignor to the Thomson-Houston Electric Co., of Connecticut.

435,668 Electric cigar lighter; John Roberts, Pittsburgh, Pa., assignor of two-thirds to Homer H. Redpath and Ivin Redpath, same place.

435,679 Method of and apparatus for producing musical sounds by electricity; Geo. Breed, U. S. Navy.

435,687 Method for charging and using secondary batteries; Thos. A. Edison, Menlo Park, N. J., assignor to the Edison Electric Light Co., New York, N. Y.

435,688 Process of and apparatus for generating electricity. 435,689 Telegraphy; Thos. A. Edison, Menlo Park, N. J.

435,690 Method of making armatures for dynamo-electric machines; Thos. A. Edison, Llewellyn Park, N. J.

435,695 Electric current indicator; Albert B. Herrick, New York, N. Y., assignor to The Bergmann & Co., same place.

435,710 Device for controlling the current of electric generators; Harry W. Leonard, Chicago, Ill.

435,744 Electric motor; Harry Groswith, Philadelphia, Pa., assignor by direct and mesne assignments of three-fourths to Chas. W. Kennedy, same place.

435,851 Telegraphy; Alexander Muirhead, London, England.

435,870 Suspending device for overhead electric conductors; Elihu Thomson, Lynn, Mass.

435,872 Pole for electric wires, etc.; Edmund Verstraet, St. Louis, Mo., assignor of one-half to Peter M. Kling and Geo. J. Robusch, same place.

435,879 Electric railway; Rudolph M. Hunter, Philadelphia, Pa.

435,893 435,894 Electrical signaling apparatus; Adin A. Hatch, Kansas City, Mo., assignor to Benjamin F. Jones, Edw. L. Martin and Alfred N. Jones, all of same place.

435,896 Electrical indicator; John W. Howell, Newark, assignor to the Edison Lamp Co., Harrison, N. J.

435,897 435,898 Electrical controlling and operating apparatus; Edw. H. Johnson, New York, N. Y., assignor to the Interior Conduit and Insulation Co., same place.

435,899 Electric current regulator; Edward H. Johnson, New York, N. Y.

Proposals for the construction and erection of a police patrol telegraph and telephone system.

OFFICE OF THE COMMISSIONERS, D. C.,
WASHINGTON, September 1, 1890.

Sealed proposals will be received at this office until 12 o'clock, M., Thursday, September 11, 1890, for the construction and erection of a police patrol telegraph and telephone system in the Eighth Precinct, City of Washington, District of Columbia.

Blank forms of proposals and specifications can be obtained at the office of the Superintendent of the Telegraph and Telephone Service, corner of Fifth and D streets, N. W., Washington, D. C., upon application therefor, together with all necessary information, and bids upon these forms only will be considered.

The right is reserved to reject any and all bids or parts of bids.

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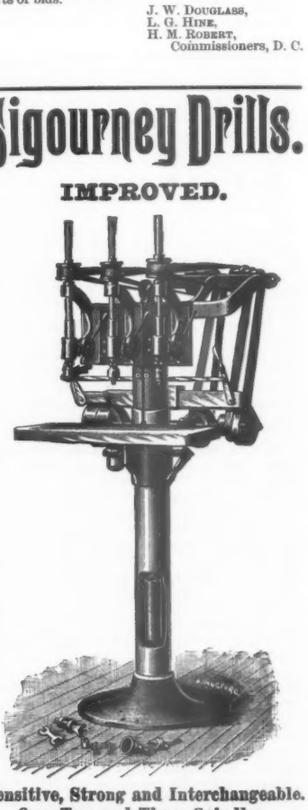

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has had the advantage of a wide experience with electrical inventions, formerly in the Examining Corps of the Patent Office, where he was detailed to examine electrical inventions, and for the past three years as an active practitioner.

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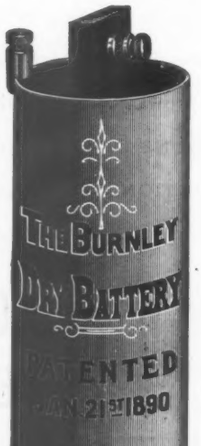

"Its internal resistance (.1 of an ohm) was very much lower, while the E. M. F. was considerably higher. It maintained its potential well when at work, and quickly became depolarized when allowed to rest. The Burnley cell seems in every particular to be electrically superior to any of the others tested, and, in fact, to any battery of the class my experience has brought me in contact with, while it and the Silvertown dry cell have the merit of being mechanically stronger and more portable than the ordinary glass contained. The Burnley dry cell is also very much superior as a secondary battery. After passing a current of 2½ amperes from a dynamo for 1½ hours through an exhausted cell, and finding it then to be capable of doing even more work than when perfectly new, I am inclined to wonder whether this form of sealed cell cannot be charged and recharged more or less indefinitely at trivial cost, and so become of far greater value than even its inventors anticipated.

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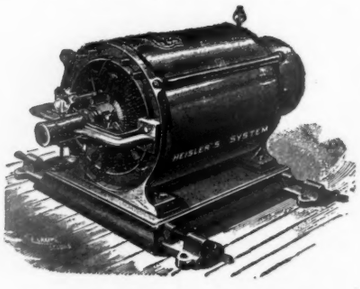

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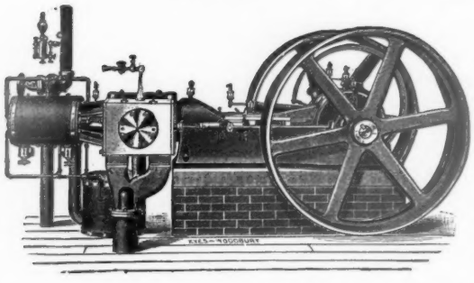

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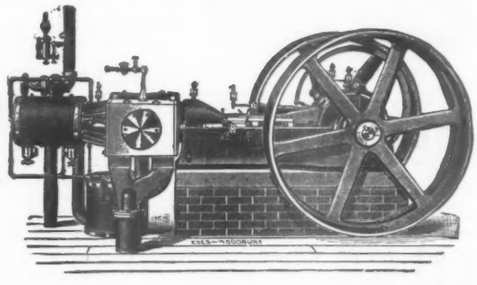

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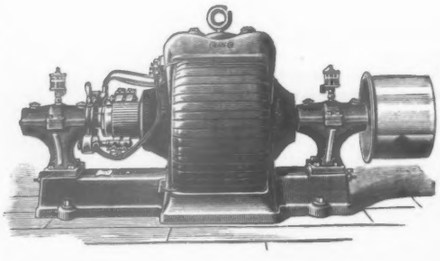

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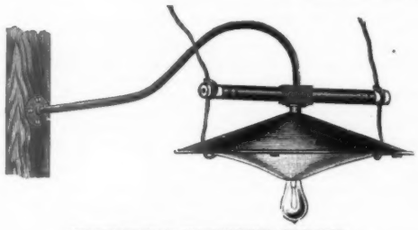

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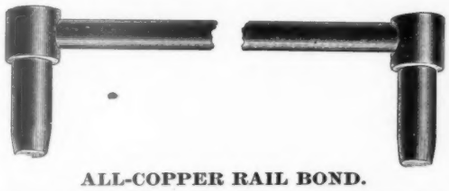

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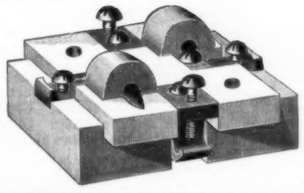

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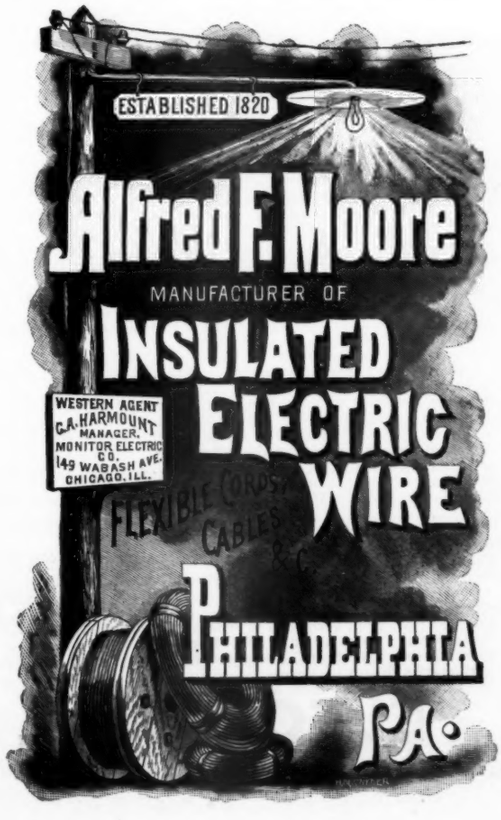

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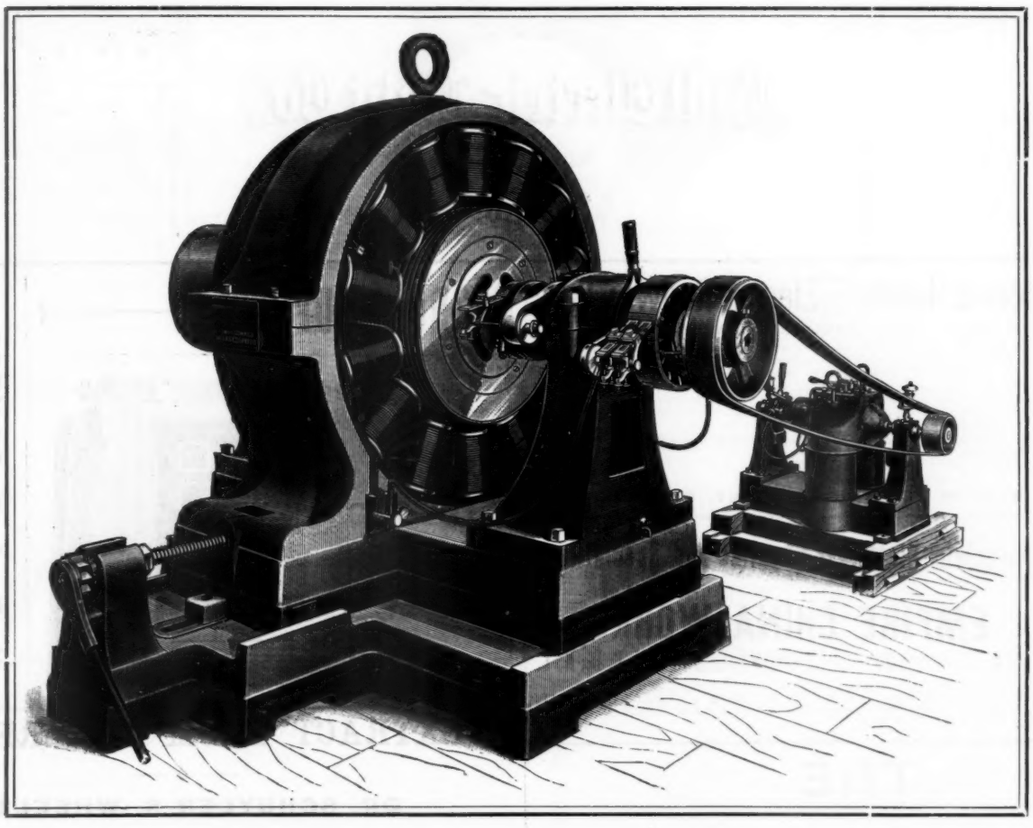

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C	.....	10	.....	.....	6.3	1½		530
C	.....	.....	.....	25	8.0	2		530
E	16	.....	.....	.....	12.0	2½		780
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E	.....	.....	26	.....	13.0	2½		780
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C	.....	.....	45	.....	21.0	4		1,360
C	.....	.....	.....	70	21.0	4½		1,360
H	40	.....	.....	.....	29.7	6		1,750
H	.....	50	.....	.....	30.0	6		1,750
I	52	.....	64	.....	29.5	6		1,750
I	.....	65	.....	.....	38.0	8		2,290
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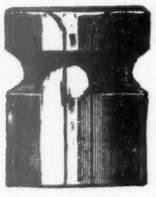

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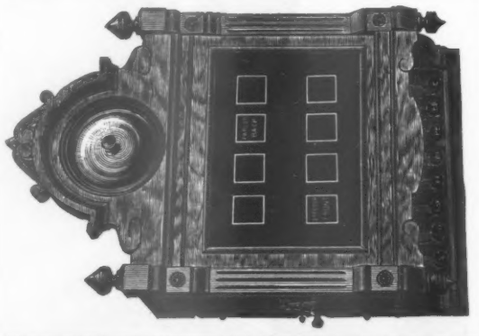

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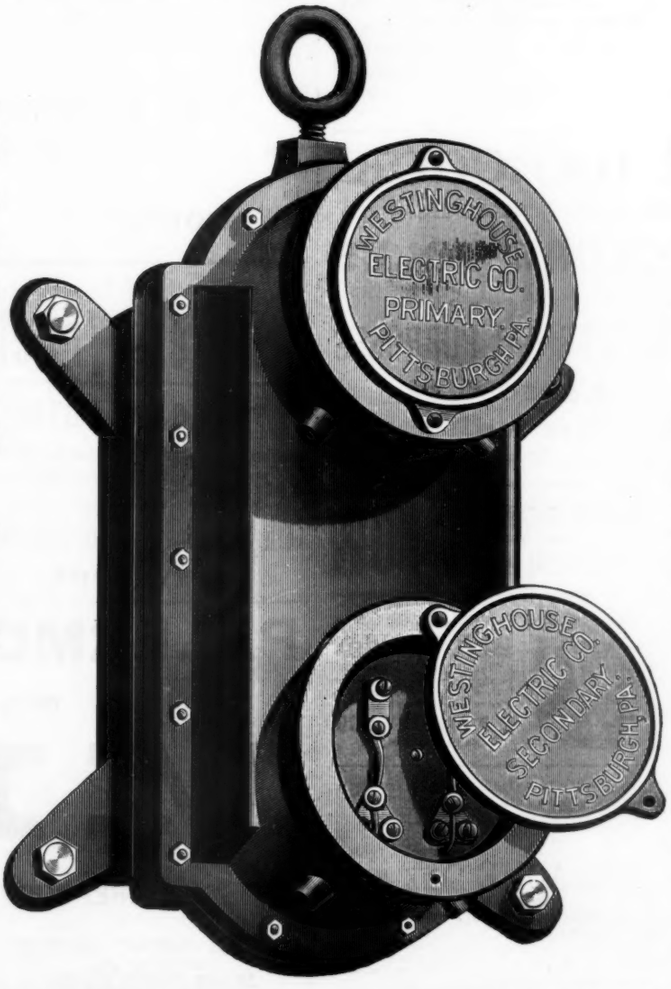

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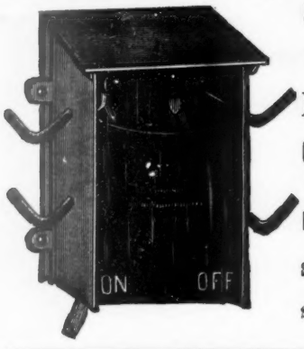

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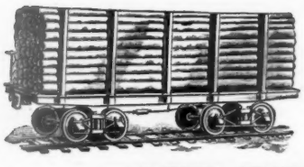

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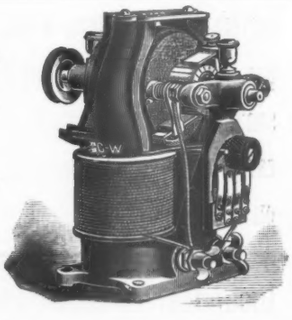

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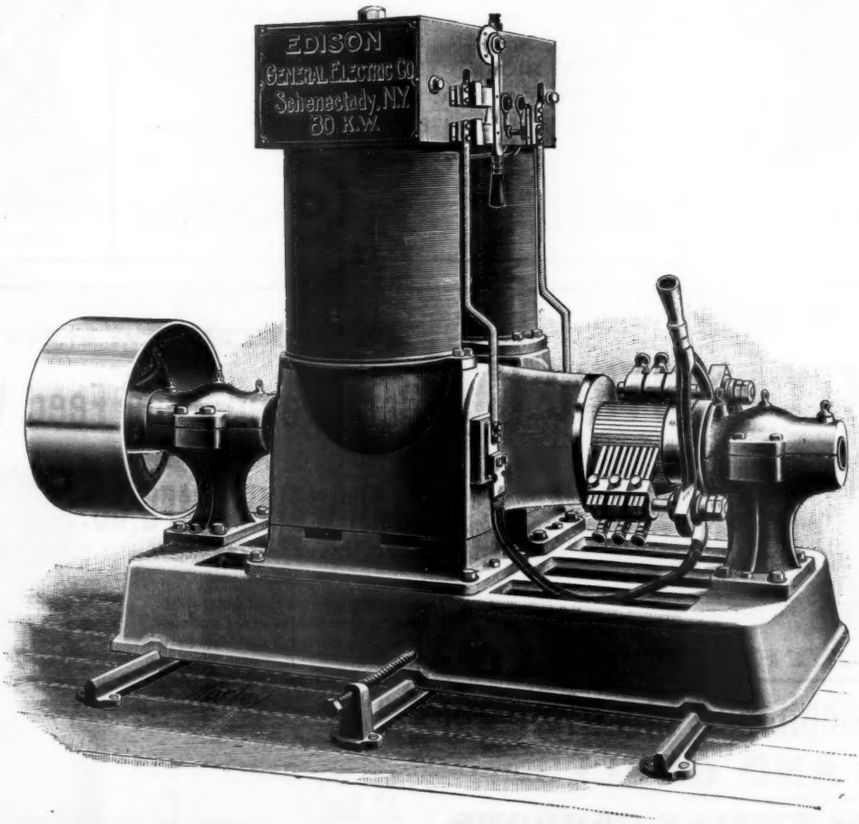

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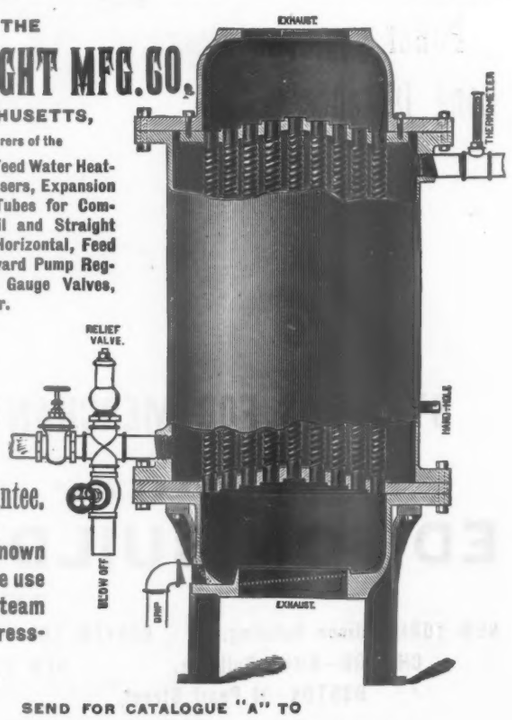

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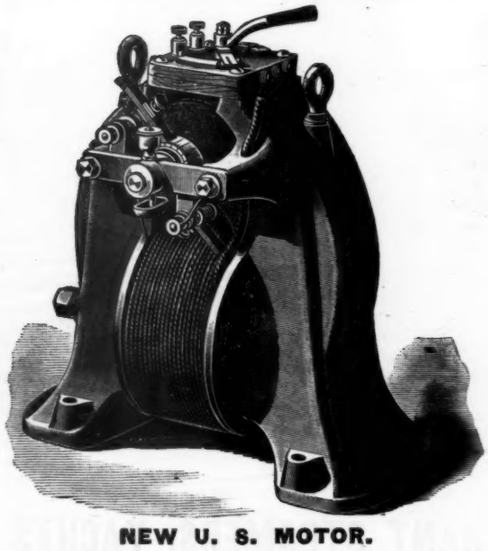

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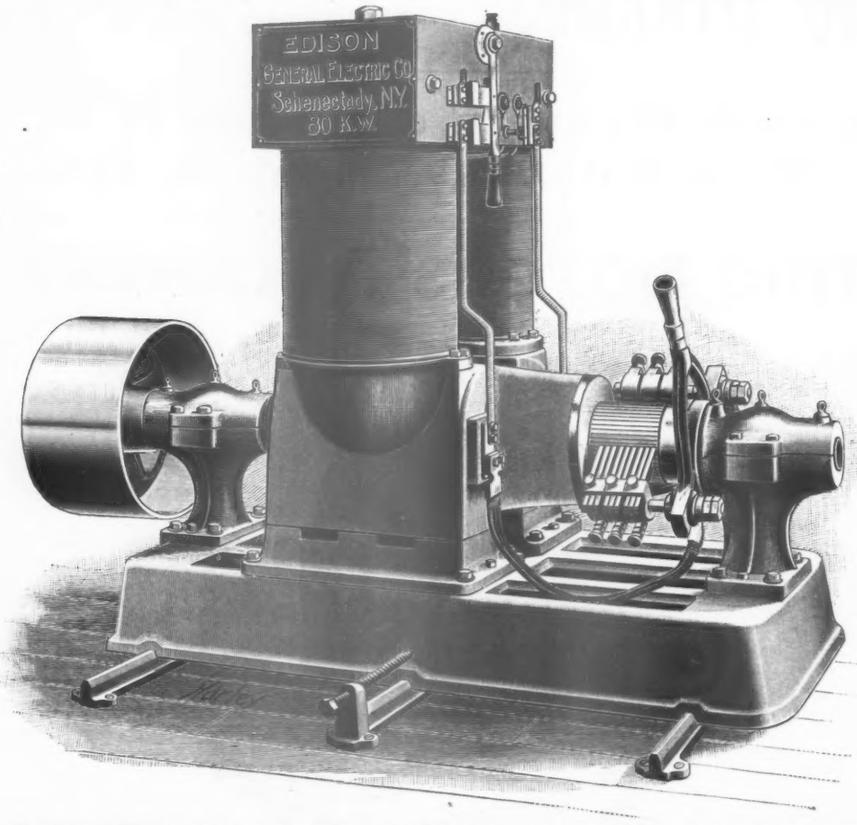

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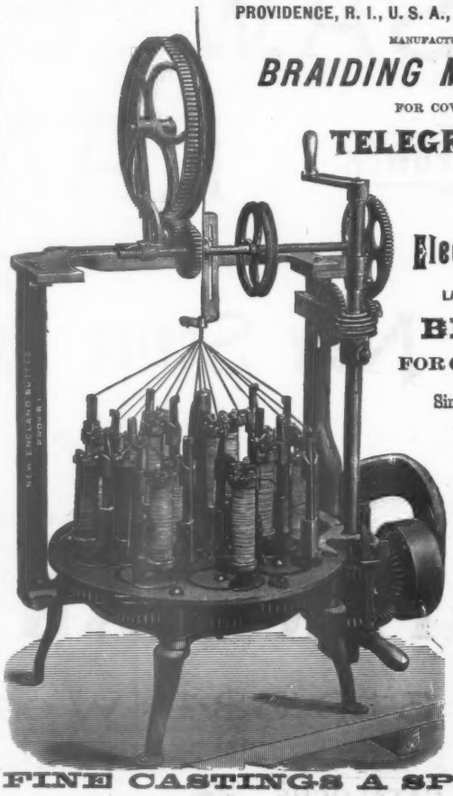

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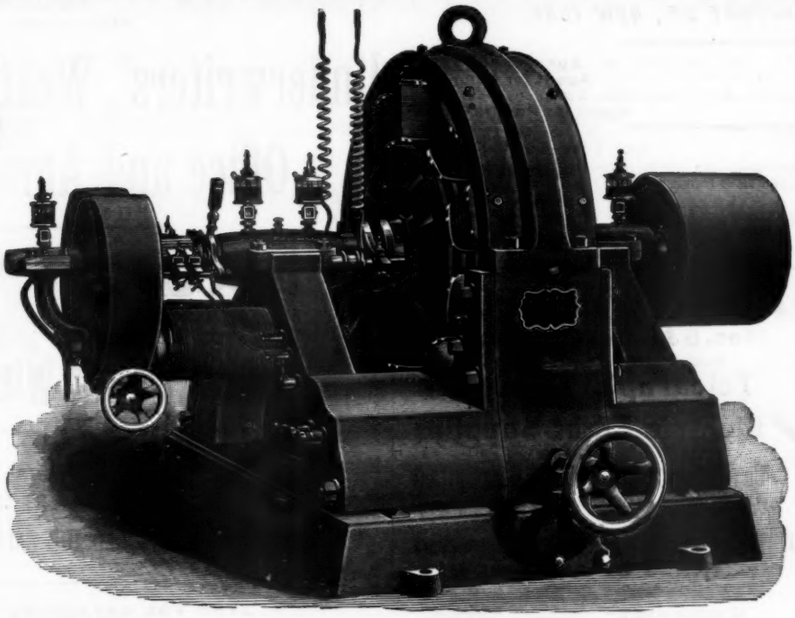

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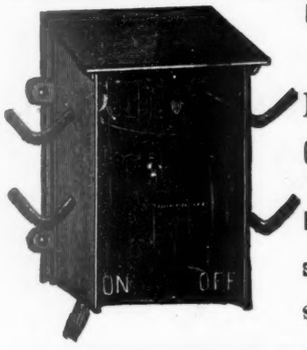

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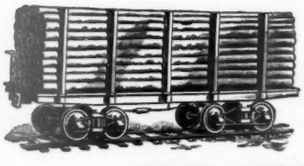

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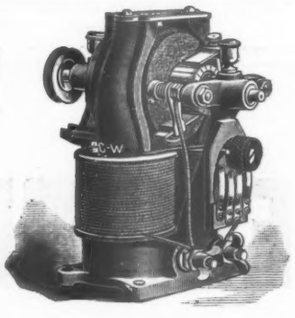

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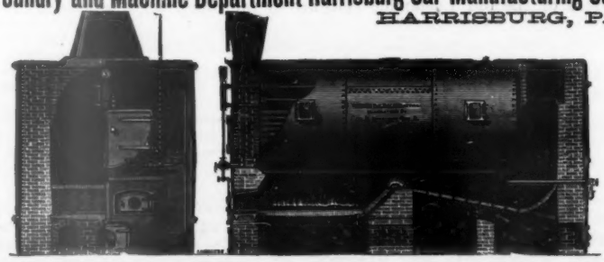

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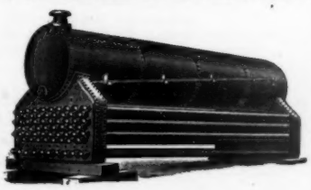

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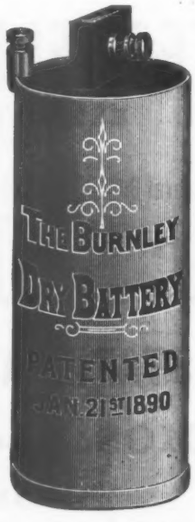
"I have carefully tested the two Burnley dry cells which you sent me for the purpose, and have compared their performances with a Silvertown dry cell, specially ordered for the purpose of 'a number of tests.' It will be seen from the various tests and curves on the enclosed tracing, that the Burnley cell yielded greatly superior results.



"Its internal resistance (.1 of an ohm) was very much lower, while the E. M. F. was considerably higher. It maintained its potential well when at work, and quickly became depolarized when allowed to rest. The Burnley cell seems in every particular to be electrically superior to any of the others tested, and, in fact, to any battery of the class my experience has brought me in contact with, while it and the Silvertown dry cell have the merit of being mechanically stronger and more portable than the ordinary glass contained. The Burnley dry cell is also very much superior as a secondary battery. After passing a current of 2½ amperes from a dynamo for 1½ hours through an exhausted cell, and finding it then to be capable of doing even more work than when perfectly new, I am inclined to wonder whether this form of sealed cell cannot be charged and recharged more or less indefinitely at trivial cost, and so become of far greater value than even its inventors anticipated.

"The internal arrangement of the two Burnley cells sent is good, the zinc stout and fairly pure, the quality of the carbon excellent, the agglomerate well compressed, and the whole effectively sealed.

"An improvement is made in the manner of contact with the carbon plate, whereby the old lead cap, with its constant liability to electrical fault (with which all large users of the old Leclanche cells are so familiar), is done away with."